

**Exotic Species Threat Assessment and  
Management Prioritization for  
Sequoia-Kings Canyon and Yosemite National Parks**

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## Executive Summary

This document reports the results of exotic species surveys at Sequoia-Kings Canyon and Yosemite national parks, the findings of a comprehensive literature review of the biology and ecology of all exotic plant species found during surveys in the parks and the ranking of those species for prioritizing management and control programs. Surveys primarily targeted areas of human disturbance, such as campgrounds, corrals, houses, roads, trails and pastures. Exotic species richness was compared across elevational gradients within the parks. To compare and contrast species composition among sites, an exploratory cluster analysis of the sites included in the species-richness-by-elevation figures was conducted using ordination techniques. All exotic species discovered during the directed surveys were grouped into one of four management priority categories based on their attributes, potential impacts, and geographical extent ([Tables 5](#) and [6](#)). **Category 1** species are exotics that are currently restricted to a relatively small number of sites in each park and have either been shown to greatly affect native vegetation or have a high probability of causing serious impacts. **Category 2** species are ones that generally have a lesser affect on native vegetation and are restricted to a relatively small number of sites. **Category 3** species are those that have been shown to have a great affect on native vegetation, are broadly distributed in the parks, and are apparently increasing their ranges within the parks. **Category 4** species are those that were detected by the surveys but not assigned to one of the three ranked categories and are considered low priority species.

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# Contents

<a href="#">Executive Summary</a> .....	<i>i</i>
<a href="#">Acknowledgments</a> .....	<i>ii</i>
<a href="#">Preface</a> .....	<i>iv</i>
<a href="#">Part I: Introduction</a> .....	1
<a href="#">Part II: Directed survey results</a>	
<a href="#">Sequoia and Kings Canyon National Parks</a> .....	4
Sequoia-Kings Canyon survey and quadrat data .....	4
Decline of exotic species richness with increasing elevation .....	5
Similarity of exotic species composition among sites .....	8
<a href="#">Yosemite National Park</a> .....	10
Yosemite survey and quadrat data .....	10
Yosemite NP survey results .....	12
Decline of exotic species richness with increasing elevation .....	12
Similarity of exotic species composition among sites .....	14
<a href="#">Part III: Exotic species threat assessment and prioritization</a> .....	15
Introduction .....	15
Priority exotic species other than grasses .....	17
Priority exotic grass species .....	26
<a href="#">Part IV: Additional Recommendations</a> .....	31
<a href="#">Part V: Literature Cited</a> .....	32
<a href="#">Table 1</a> . Interpretation of Sequoia-Kings Canyon NP site cluster analysis .....	38
<a href="#">Table 2</a> . Exotic plant species richness by survey type and by site, Yosemite National Park .....	40
<a href="#">Table 3</a> . Yosemite NP 1998 trail survey data .....	42
<a href="#">Table 4</a> . Yosemite NP 1999 trail transect and survey data .....	43
<a href="#">Table 5</a> . Interpretation of Yosemite NP site cluster analysis .....	44
<a href="#">Table 6</a> . Priority exotic species other than grasses .....	46
<a href="#">Table 7</a> . Priority exotic grass species .....	48
<a href="#">Figure 1</a> . Sequoia-Kings Canyon NP exotic species richness by elevation .....	49
<a href="#">Figure 2</a> . Sequoia-Kings Canyon NP site cluster analysis .....	51
<a href="#">Figure 3</a> . Arrangement of 1999 transects in Yosemite National Park .....	10
<a href="#">Figure 4</a> . Yosemite NP exotic species richness by elevation .....	52
<a href="#">Figure 5</a> . Yosemite NP site cluster analysis .....	53
<a href="#">Appendix A</a> Sequoia-Kings Canyon NP - priority exotic species by site .....	54
<a href="#">Appendix B</a> Yosemite NP - priority exotic species by site .....	60
<a href="#">Appendix C</a> Field notes of Sequoia-Kings Canyon NP survey crews .....	68
<a href="#">Appendix D</a> Yosemite NP exotic plant species of roadsides .....	91
<a href="#">Appendix E</a> Yosemite NP exotic plant species of trailsides .....	96
<a href="#">Appendix F</a> Yosemite NP exotic plant species of corrals and stables .....	100
<a href="#">Appendix G</a> Statewide distributions of priority exotic plant species .....	103
<a href="#">Appendix H</a> Maps of survey areas and selected species .....	117

## **Preface**

The introduction and establishment of non-native plants and animals is a global environmental problem that has steadily worsened over the past few decades. Nowhere is the concern greater than in nature reserves designed to conserve examples of biodiversity and other unique landscape features. The U.S. National Park Service plays an important role as ecological steward over many highly prized and valuable remnants of the natural landscape of the United States. Invasive or exotic species pose threats to the maintenance of many of these ecosystems, both through their displacement of the native flora and fauna as well as upsetting natural ecosystem processes. Thus, it is vitally important that research be devoted to understanding the threat and means of eliminating these exotics, or in some cases learning how to mitigate their effect. This study is a first attempt at addressing the problem of non-native plants in Sequoia-Kings Canyon and Yosemite national parks. The focus is on determining the extent and location of exotic species, determining which of these pose the greatest threat, and evaluating the extent to which these problems are tractable. While this project focuses on a localized region of the Sierra Nevada Mountain Range of California, it is hoped that this approach may be of broader use in solving exotic species problems in other regions as well.

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## Part I. Introduction

In 1998, the U.S. Geological Survey initiated a survey to describe the distribution and abundance of exotic plants in disturbed areas of Yosemite, Sequoia and Kings Canyon national parks. In this report, and administratively, Sequoia NP and Kings Canyon NP are treated as a unit, referred to as Sequoia-Kings Canyon NP. This study built on over a year's worth of prior work done in Sequoia-Kings Canyon NP to assess the invadedness of sites that had seen short- and long-term disturbance, both natural and anthropogenic. Methods were standardized among the parks, thereby laying the groundwork for providing managers with information to assist in managing invasive nonnative plants in the Sierra Nevada national parks. Exotic plants were mapped, site characteristics described and permanent records created for evaluating the current status of exotics in the parks and to provide a basis for managers to decide on appropriate direction and levels of response.

This document reports the results of exotic species surveys at Sequoia-Kings Canyon and Yosemite National Parks, the findings of a comprehensive literature review of the biology and ecology of all exotic plant species found during surveys in the parks and the ranking of those species for prioritizing management and control programs. Surveys largely were aimed at capturing the distribution and abundance of exotic plants, those not native to the parks, in areas of anthropogenic disturbance. They were designed to complement existing data sets available for each park that documented the distribution and abundance of all species at randomly located sites across broad elevational and latitudinal gradients. Areas of human disturbance targeted for surveys in Sequoia-Kings Canyon NP included campgrounds, corrals, developments, roads, trails and pastures. Surveys in Yosemite NP focused on campgrounds, corrals, developments, roads and trails. Lower elevation riparian areas, sites of natural disturbance, were targeted as well in Sequoia-Kings Canyon NP.

Disturbed areas were targeted for inventory because vascular plant surveys in undisturbed sites discovered few of the exotics encountered during casual observations of heavy use areas. A handful of exotic species are well known and have been managed for years in Yosemite. However, there was clearly a need to document the pattern of exotic plant establishment for all other exotic species present and to predict those that could pose the greatest threats to the parks.

A comprehensive literature review was done for each species encountered during surveys to derive detailed information on biological characteristics (seed production and viability, mode of reproduction, dispersal habits, etc.), on distributional patterns and known invasiveness and on control methods (effectiveness of mechanical, chemical or other treatments). Only a subset of information may be available for some species; no information may be available for others. Detailed and specific information is published for a few. Considered together, known characteristics can help managers compare the potential threat posed by species or categories of species.

The process of ranking exotic species for management took into account many of the biological and control factors recommended in the invasive species literature (for examples see Hiebert and Stubbendieck 1993). It empirically blended those factors with local and regional information concerning the invasiveness and ecological impacts of each exotic species. This less-than-quantitative approach was necessary because of the lack of published data concerning the biological and ecological characteristics of many of the exotic species and because the parks encompass a wide range of habitats across an elevational gradient that runs from under 2000 ft. to over 14000 ft. Species and site information is provided in the summaries that were compiled from various sources while generating this report (see [Part III](#)). Because of different sampling approaches and management needs, the exotic species problems of Sequoia-Kings Canyon NP and Yosemite NP are addressed in separate sections. However, the parks share many of the same problems, and the information concerning each of the parks provides valuable information that can be helpful in understanding and managing exotic plant species in all of the parks.

## Background

Invasive exotic plants can bring about significant changes in park ecosystems by changing structural attributes of native plant communities (physiognomy, species composition, genetic diversity) and the processes that support them (fire frequency, nutrient cycling, hydrology, soil erosion, decomposition) (Macdonald et al. 1988). For instance, the establishment of *Tamarix ramosissima* (tamarisk) has dramatically altered stream geomorphology in southwestern riparian corridors including the Green River in Canyonlands National Park (Graf 1978) and reduced species richness along the Pecos River in New Mexico and Texas (Brock 1994). In Hawaii Volcanoes National Park, *Myrica faya* (fire tree) has been shown to profoundly alter nutrient cycling on early successional volcanic sites by increasing the amount of available nitrogen, resulting in further invasion by other nonnative plants (Vitousek and Walker 1989). In addition, annual non-native grasses have caused an increase in fire frequency in some woodlands (D'Antonio and Vitousek 1992). These are just three of many examples detailing the effects introduced species have on native ecosystems; see Macdonald et al. (1988) and Vitousek et al. (1996) for others.

Nonnative plants are most likely to establish in areas that have both a source of seeds and which undergo repeated disturbance. In parks and reserves, these include developed areas such as roads and trails, campgrounds, pack stations, water treatment facilities and residential areas (Macdonald et al. 1988, Cowie and Werner 1993). Viable plant parts are transported to these sites via clothing, animal fur and digestive systems, vehicle tires, heavy equipment, slope stabilization materials and wind (Hodkinson and Thompson 1997, Ridley 1930, Schmida and Ellner 1983). In natural systems, river corridors and riparian areas are especially vulnerable (DeFerrari and Naiman 1994, and others) as they are subject to regular disturbance, the agent of disturbance is also an agent of propagule transport and moisture is readily available well into or throughout the growing season (Pyšek and Prach 1994). Exotic plant propagules arrive in stream systems via many of the same vectors as those active in terrestrial sites with the addition of wading birds and water transport among stream reaches.

Although not all exotic plants are invasive or pose a threat to natural ecosystems, many nonnative plants appear to undergo a lengthy period of establishment, remaining restricted to roadsides and disturbed areas for many years before beginning to invade adjacent native vegetation. Populations may then grow exponentially, and a species initially thought to pose little or no threat as a roadside weed can become a serious pest. *Mimosa pigra* (catclaw mimosa), for example, was unrecognized as a serious weed in the Northern Territory of Australia until 80 years after it was introduced; it is now considered one of the most important wetland weeds in the region (Cowie and Werner 1993).

Invasive nonnative plants currently infest an estimated 2.8 M ha of National Park System lands, costing millions of dollars annually in control efforts (National Park Service 1996). In Yosemite alone, approximately \$17,500 is spent on control each year. This amount doubles when in-kind contributions are included (S. Fritzke personal commun.). At Sequoia-Kings Canyon NP, a small volunteer program under staff direction has been relied on in the past to address exotic plant management. However, in 2001, an exotic management program will invest significant funds in the control of incipient populations. Inventories of the current distribution of exotic species addresses the need of managers to have information on all potential invaders so that priorities can be established for monitoring and control.

## Study Areas

Sequoia-Kings Canyon NP forms a contiguous reserve of 349,525 ha located on the western slope of the south-central Sierra Nevada of California. This reserve ranges in elevation from 400 m in the western foothills to 4,418 m on the crest of the Sierra Nevada and is composed of rugged, mountainous terrain; over 70% of park lands are above 2,500 m elevation. Three major river systems—the Kings, Kern and Kaweah—originate within and drain the reserve; additionally, the northernmost boundary of Kings Canyon National Park includes a portion of the headwaters of the south fork of the San Joaquin River.

Yosemite National Park is a 302,768 ha reserve located in the central Sierra Nevada. It ranges in elevation from 640 m in the Merced River Canyon to 3,997 m atop Mt. Lyell. The park is comprised of two major watersheds, the Merced River in the south and the Tuolumne River in the north, and completely encompasses the headwaters of each. Two-thirds of Yosemite lies between 2,100 and 3,050

m, resulting in a higher proportion of forested terrain than the southern parks and a lower proportion of alpine habitat.

The vegetation of all three parks is quite varied, reflecting the substantial environmental heterogeneity created by a large elevational gradient. Vegetation types include chaparral, oak woodland, upland hardwood forest, conifer forest and woodland, meadows, and alpine plant communities (Vankat 1982, Haultain et al. 1988; Moore 1993). The parks support rich and diverse vascular floras with nearly 1,500 taxa in both Sequoia-Kings Canyon and in Yosemite.

With the arrival of Europeans in the 1850s, livestock grazing became prevalent and intense throughout the region, continuing in the foothills until the parks were established in 1890 (Macdonald et al. 1988). Grazing was suppressed more slowly over the next two to three decades at the higher elevations. During this time, Mediterranean annual grass species became established in the lower elevations, marking a shift to dominance by nonnative species in the understory of the blue oak savannah and in foothill grassland sites which persists throughout California to this day (Rejmanek et al. 1991). Grazing is currently limited in the foothills to a government pasture at each park and in the montane and subalpine areas to recreational and administrative pack stock.

Today, visitation has reached 1.4 million at Sequoia-Kings Canyon NP, nearly 4 million at Yosemite NP. In 1998, an estimated 2.1 million visitors to Yosemite entered Yosemite Valley, over 90% of them in private vehicles (NPS 2000, IA:3-97). Commercial vehicles (vendors, contractors) travel from various parts of the region to support concession and administrative functions (P. Moore, personal observation). Pack stock animals are moved in and out of the parks seasonally to gain access to winter pastures. Native herbivores migrate into and around the parks to follow forage availability as well (S. Thompson, personal commun.). Exotic plants are faced with few barriers to their transport across park lands, but information is the first step toward addressing the issues.

Note: Because Sequoia NP and Kings Canyon NP are administered as a single unit, despite their individual legislative designations as national parks, and they were surveyed by a single team. Therefore, they are referred to here as if they are a single unit and contrasted with Yosemite National Park approximately 40 km north. Exotic species occurrence is presented for Sequoia-Kings Canyon NP as if they are one unit; however, species occurrence is documented by site, and summary information could be derived for each park separately should the need arise.



## Part II. Directed Survey Results

### SEQUOIA AND KINGS CANYON NATIONAL PARKS

#### Sequoia-Kings Canyon NP Survey and Quadrat Data

**Field Methods** - In 1996, 1997 and 1998 directed surveys were conducted in Sequoia-Kings Canyon NP to assess the richness, distribution and abundance of exotic plant species. The surveys consisted of complete inventories of all exotic (non-native) plant species present within the boundaries of the target site. These surveys were supplemented by quadrat-based sampling of some campgrounds/camps, developments, and pack stations in 1998. Surveys were completed in areas where exotics plant species are most likely to be introduced and dispersed, and the sites surveyed included campgrounds, developed areas, trails, improved roads, dirt roads, pack stations, pastures, and riparian zones. Developments and developed areas refer to areas that are significantly altered by the installation of structures, utilities and pavement such as accommodations, visitor centers and offices. Surveys at Lodgepole Campground, Lodgepole Village and Ash Mountain developed areas, Wuksachi Village construction site, and along Generals Highway did not record all exotic plant species due to logistical constraints. Also, at several sites, the surveys included portions of natural areas, trails, roads, and developments adjacent to the particular site. Except for the Ash Mountain Development survey, which identified 71 exotic plant species, data from surveys that did not completely sample a well defined site were not included in site-by-elevation figures or the cluster analyses described later in this report. The data for Grunnigan Ranch contain a large number of cultivated exotic plants and also is not included in the figures or cluster analyses. Additionally, a few sites were sampled using quadrat techniques but only the exotic species richness data are presented in this report. However, all of the data collected during the surveys and quadrat sampling were considered in the exotic species prioritization and recommendations sections of this report.

The Sequoia-Kings Canyon NP survey crews assigned each site to a particular site category, e.g. campground. However, the criteria they used to define site types were not the same as those used by the Yosemite crew. In general, the criteria used by the Yosemite crews produced smaller and more sharply defined survey areas. The extensive documentation of site characteristics in the Sequoia-Kings Canyon NP survey reports allowed the assignment of exotic plant species to comparable site types based on the Yosemite site definitions. In a small number of cases an exotic species could either not be assigned to a group other than “natural area” or was part of a very small supplemental survey such as an improved road adjacent to a campground. In those cases, the survey data were not included in the site-by-elevation figures or in the cluster analyses but has been included in the exotic species prioritization and recommendations sections of this report. The exotic species presence/absence survey data for the 55 km long Rae Lakes Loop Trail and the 19 km long Kern Canyon Trail were divided into 1000 ft. elevational segments of undetermined lengths based on statements in the survey reports.

Directed, non-plot-based surveys were conducted throughout the sites. Environmental factors for each exotic species encountered were recorded. Factors included elevation, slope, aspect, percent canopy closure, community type, associated species, abundance, and distribution. Abundance figures were taken according to a logarithmic scale (1-10, 11-100, 101-1000, and >1000). These figures reflect the number of individuals of a single species observed throughout the entire survey area. Distribution observations for each exotic species were categorized as scattered individuals, scattered clumps of individuals, large clumps of many individuals, or widespread throughout the area. The survey crews also recorded brief written descriptions of each species encountered. Descriptions included additional environmental factors such as type and intensity of disturbance. Universal Transverse Mercator coordinates were recorded for each species. These coordinates were obtained from either a PLGR-type global positioning device or directly from USGS 7.5' quadrangles. The Jepson Manual: Higher Plants of California (Hickman 1993) was used to determine which plant species were not indigenous to the parks.

The quadrat-based sampling method was conducted in 1998 only at campgrounds/camps, developments and pack stations. A baseline transect was first established along one edge of each patch, and a random number table was used to randomly place sampling transects perpendicularly along the length of the baseline. Quadrats (1 m<sup>2</sup>) were placed randomly along the sampling transects until thirty quadrats had

been sampled. When thirty quadrats were sampled before the end of a sampling transect, the remainder of the sampling transect was also sampled to avoid biasing the data toward the beginning of the transect. In each quadrat, the cover of non-native and native plant species was estimated to the nearest one percent. While the cover of a particular species could not exceed 100%, the total of all species in the quadrat frequently exceeded 100%. Additionally, a natural vegetation control site was established in undisturbed vegetation 50 m from one site in each site category.

The sample sites frequently contained areas such as parking lots or tent pads that were inappropriate for sampling, so quadrats had to pass rejection criteria before field crews sampled them. Randomly placed quadrats were rejected if more than 50% of the cover was incapable of supporting plant life (pavement, dirt roads, large boulders, and trampled areas within 1 m of a structure). Areas where exotics are cultivated (lawns, flower pots, and gardens) were also rejected because exotic species are deliberately cultivated in them. If the crews rejected several quadrats, they added additional transects until 30 quadrats were sampled. In areas that were sampled for cover, the canopy cover of shrubs and trees was also recorded. Shrub cover along the length of transects was measured using the line intercept method. Field crews used periscopes to measure the presence or absence of tree canopy in the cross-hairs of the periscopes. At each site 100 canopy points were distributed at regular intervals along the transect. The quadrat sampling data were analyzed for exotic species richness and are included in the richness-by-elevation figures below.

### **Decline of Exotic Species Richness with Increasing Elevation**

**All sites** - Graphs of site exotic species richness against site elevation indicate that exotic species richness is strongly negatively correlated with elevation when all sites are pooled ([Figure 1a](#)). This negative correlation is evident for six of the seven site types when the graphs are restricted to particular site types ([Figures 1b-1h](#)). The site-restricted graphs also indicate that each site type is restricted to limited portions of the elevational gradient that runs from 1398 ft. to 10,800 ft. and that sampling effort varied with elevation and site type. These are unavoidable problems when only a limited number of discrete sites are available for sampling, and they affect the inferences that can be made from the data. On the positive side, for some site types, such as camps and pack stations, the entire population of sites was sampled so statistical models are not required to predict the number of exotic species at another site that was not sampled.

**Campgrounds/Camps** – Exotic species richness in campgrounds is likely due to differences in both the distribution of habitat types along the elevational gradient as well as the location and types of disturbances. Potwisha Campground (44 spp., 48,000 m<sup>2</sup>, 2117 ft.) lies on an ecotone between Blue Oak Woodland and Canyon Live Oak Woodland vegetation types. While its location on an ecotone suggests that it may have a large number of exotic species because of diverse habitats, almost all of the exotic species present are either common in the Blue Oak Woodland vegetation type or are soil disturbance specialists. Buckeye (25 spp., 8000 m<sup>2</sup>, 2822 ft.) and South Fork (15 spp., 9000 m<sup>2</sup>, 3728 ft.) campgrounds are both located in Canyon Live Oak vegetation and contain many of the same exotic annual grass species but Buckeye has a more diverse exotic forb (nongrass, nongrasslike herbs) flora.

Sheep Creek (7 spp., 96,000 m<sup>2</sup>, 4564 ft.) and Moraine (3 spp., 106,000 m<sup>2</sup>, 4764 ft.) campgrounds are located in Mixed Conifer vegetation with broken canopies and sandy soil. The dominant exotic species at both sites are *Bromus tectorum* (cheat grass) and *Vulpia myuros* (rattail fescue), both of which are short-lived annual grasses. Sheep Creek's greater species richness is due to a few perennial species that are restricted to areas that receive supplemental water such as ditches and drinking fountains.

Swale Administrative Campground (6 spp., 10,000 m<sup>2</sup>, 6223 ft.) in Mixed Conifer vegetation and Atwell Mill Campground in White Fir/Big Tree vegetation (5 spp., 17,000 m<sup>2</sup>, 6415 ft.) have similar exotic species compositions except that no grasses are present at Swale while all the exotic species at Atwell Mill Campground are located in a single seep that is dominated by *Poa pratensis* (Kentucky bluegrass). Azalea Campground (16 spp., 76,000 m<sup>2</sup>, 6454 ft.), Crystal Springs Campground (5 spp., 65,000 m<sup>2</sup>, 6631 ft.), and Dorst Campground (19 spp., 140,000 m<sup>2</sup>, 6721 ft.) are located in White Fir vegetation interspersed with Montane Meadow vegetation. The exotic species at Azalea were found during the

comprehensive survey primarily in a highly disturbed and trampled portion of a meadow at the southwest corner of the campground or in seeps and wet areas. Consequently, the quadrat-based sampling (2 spp., 30 m<sup>2</sup> sampling area) missed most of the exotic species (see arrow in [Figure 1b](#)). No exotic species were found in the control quadrats outside of the campground. This suggests that the exotic species in the campground are not invading adjacent undisturbed vegetation; however, no comprehensive survey was made of the control site and many of the exotic species are restricted to wet micro habitats. The exotic species at Crystal Springs Campground are primarily restricted to the margin of a relatively undisturbed meadow. In contrast, at Dorst Campground most of the exotic species are found in disturbed soils near roads and structures. Cold Springs Campground (9 spp., 7477 ft.) is located in Jeffrey Pine/Fir vegetation and most of the exotic species are found along moist roadsides or in dirt roadbeds.

**Developments** – There were clear changes in exotic species richness and composition with changes in site elevation among developments ([Figure 1c](#)). Because of extensive human alteration of the native vegetation in these sites, biological restrictions on exotic species due to different vegetation types should be reduced and changes in species composition with increases in elevation should more strongly reflect climatic controls. Additionally, the type of development strongly influenced exotic species richness and composition.

Ash Mountain Boundary Area (25 spp., 2000 m<sup>2</sup>, 1398 ft.) and North Fork Parking Lot (20 spp., 3000 m<sup>2</sup>, 1773 ft.) contained similar numbers of exotic species that are typical of exotic annual grassland. Ash Mountain Developed Area (71 spp., 110,000 m<sup>2</sup>, 1605 ft.) had by far the richest exotic species flora of any site. The species included typical annual grassland species, species that are lawn and disturbed soil specialists, horticultural species, and waifs. Middle Fork Flume (32 spp., 2112 ft.) and Hospital Rock (32 spp., 12,000 m<sup>2</sup>, 2697 ft.) sites were similar to the Ash Mountain Boundary and North Fork Parking Lot sites except that they contained a richer annual grassland forb flora. The exotic flora of Cedar Grove Market and Lodge (12 spp., 21,000 m<sup>2</sup>, 4671 ft.) appears to have lost most of the typical annual grassland exotic species that are found at lower elevations and is a mixture of perennial grasses (*Poa pratensis* and *Poa bulbosa* [bulbous bluegrass]), species that specialize in disturbed soil, and short lived annual grasses (*Bromus tectorum* and *Vulpia myuros*). The flora of Crystal Cave Parking Lot (15 spp., 4000 m<sup>2</sup>, 4897 ft.) and Milk Ranch Lookout (8 spp., 3000 m<sup>2</sup>, 6211 ft.) are very similar and contain many exotic species that are typical of low elevation annual grassland as well as *Bromus tectorum* which is typical of mid elevation sites. Oriole Lake Airstrip (3 spp., 5356 ft.) has two species of low elevation annual grasses and *Plantago lanceolata* (English plantain). The Big Stump Picnic Area (5 spp., 5000 m<sup>2</sup>, 6323 ft.) flora is dominated by *Bromus tectorum* and soil disturbance-adapted forbs. With the exception of *Bromus tectorum* at the Giant Forest Sewage Treatment Plant (6 spp., 2000 m<sup>2</sup>, 6350 ft.), the flora of that site and of the Giant Forest Developed Area (6 spp., 95000 m<sup>2</sup>, 6440 ft.) consists of species that are represented by few individuals. Columbine Picnic Area (8 spp., 5000 m<sup>2</sup>, 6533 ft.) and Grant Grove Developed Area (18 spp., 200,000 m<sup>2</sup>, 6593 ft.) are noteworthy for their large populations of *Phalaris arundinacea*, *Poa pratensis* and *Trifolium repens* (reed canary grass, Kentucky bluegrass and white clover). The floras of Red Fir Maintenance Yard (12 spp., 20,000 m<sup>2</sup>, 7121 ft.) and Wolverton Snow Play Area are dominated by forb species adapted to soil disturbance. Overall, annual grass species typical of low elevation annual grassland tend to disappear at elevations between 3000 and 4000 feet except for very open or disturbed sites. With increasing elevation, the low elevation annual grasses are replaced by *Bromus tectorum* on dry, open sites and *Poa pratensis* on more mesic sites. Additionally, many of the annual forbs present in low elevation annual grassland are present in disturbed areas to elevations of 7200 ft., but they are replaced by perennial forbs such as *Cirsium vulgare*, *Taraxacum officinale* and *Trifolium repens* (bull thistle, dandelion and white clover) on less disturbed mesic sites.

**Pack Stations** – The flora of the Cedar Grove (39 spp., 3000 m<sup>2</sup>, 4701 ft.), Grant Grove (4 spp., 3000 m<sup>2</sup>, 6417 ft.), Wolverton (6 spp., 64,000 m<sup>2</sup>, 7037 ft.), and Mineral King (16 spp., 13,000 m<sup>2</sup>, 7878 ft.) pack stations is dominated by low and mid elevation annual grasses and annual forb species adapted to soil disturbance and dispersal by grazing animals. The quadrat-based survey (30 m<sup>2</sup>) of Cedar Grove pack station detected only 23 species while the control, which was located in a Ponderosa Pine/Incense-cedar forest, detected only 2 exotic species ([Figure 1d](#)). Those species, *Bromus tectorum* and *Vulpia myuros*, were only present in 3% of the quadrats at 1% cover for each species. The very low species richness at the Grant Grove pack station was due to the fact that pack animals had been placed in the corrals prior to the survey and most plants had been eaten or trampled beyond recognition. The two higher elevation pack stations contained *Poa pratensis*, *Taraxacum officinale*, *Trifolium repens*, *Rumex acetosella* (sheep

sorrel) and *Spergularia rubra* (sand-spurrey), all species that occur in mid to high elevation grazed meadows.

**Trails** – The trail floras were low in exotic species richness, and exotic species could be assigned to one of three categories based on elevation (Figure 1e). Between 2000 ft. and 4000 ft., the trails were lined with annual species that are typical of low elevation annual grassland. From 5000 ft. to 8000 ft., the trails were lined with *Poa pratensis*, *Bromus tectorum*, *Taraxacum officinale* and other forbs while *Cirsium vulgare* was common at stream crossings and in wet areas. Trails between 8000 ft. and 10000 ft. were lined only with *Poa pratensis* and *Taraxacum officinale*.

**Dirt Roads** – The flora of dirt roads was similar to the trail flora except for a greater number of forb species adapted to soil disturbance (Figure 1f). The flora of Colony Mill Road (28 spp., 2307 ft.) was dominated by species typical of low elevation annual grassland and blue oak woodland. Cattle from an adjacent private inholding were seen grazing along Oriole Lake Road (13 spp., 5342 ft.) which probably accounts for the presence of *Trifolium repens* which is dispersed in dung. The flora was dominated by *Bromus tectorum*, *Bromus diandrus* (ripgut brome) and a few soil disturbance adapted forb species. *Bromus tectorum*, low elevation annual grasses and disturbance adapted forbs were present along Mineral King Road (17 spp., 5718 ft.) and Camp Conifer Road (8 spp., 6754 ft.).

**Pastures/Montane Meadows** – Pastures are different habitats for exotic species than all of the previous site types because they contain vegetation that is dominated by native species. Exotic species that are established in pastures, all of which were identified as Montane Meadow vegetation, have demonstrated their ability to invade those natural habitats. Oriole Lake Pasture (10 spp., 5353 ft.) contains twice as many exotic species as the other pastures (Figure 1g). The probable explanation is its proximity to a dirt road and increased seed dispersal and grazing disturbance by cows from a nearby private inholding. Many of the grasses and forbs in the pasture are known to be dispersed in horse and cow dung. Half of the pastures between 6000 ft. and 9000 ft. contained only two exotic species, *Poa pratensis* and *Taraxacum officinale* while the remainder contained those species plus one to three other species. The survey crew's notes indicate that dense populations of *Poa pratensis* appeared to be excluding native species at many higher-elevation sites.

**Riparian Areas** – The habitats of the streamside sites share characteristics with both the Pasture/Montane Meadow sites and the human-modified habitat sites. They resemble Montane Meadows because native plants are present in abundance along their banks, and they resemble human-modified habitats because some areas of their banks and much of their beds are periodically cleared of all vegetation. Vegetation clearing through either human modification or flooding creates bare ground that can allow for the establishment of exotic plant propagules. Exotic species richness is high for these reasons, because moisture is available for much of the growing season and because the riparian sites that were completely sampled are at low and mid elevations (Figure 1h). More data for riparian areas was collected by the survey crews than is reported here, but, except for the following six sites, most of the data were collected as part of broader surveys, and it was not clear from the survey notes how complete those surveys were (complete survey information is presented in species distribution maps). Additionally, the six riparian sites reported here are located between two very narrow altitudinal bands (1500 to 5000 ft.). The flora of the middle fork of the Kaweah River (25 spp. 1545 ft.) includes *Ficus carica*, *Morus alba*, and *Tamarix* (edible fig, white mulberry and tamarisk), all species that are highly invasive in riparian areas in California. *Rubus discolor* (Himalayan blackberry) and *Tamarix sp.* are invading the north fork of the Kaweah River (29 spp., 1726 ft.), and the survey crew noted the presence of some cows that had eaten and trampled most of the vegetation in the stream bed. Yucca Creek's flora (37 spp., 1880 ft.) contains actively invading populations of *Juglans regia* (English walnut), *Juglans californica* (California black walnut), *Ficus carica*, *Rubus discolor*, *Vitis vinifera* (cultivated grape). Additionally, the nearby Grunnigan Ranch site hosts *Carya*, *Diospyros*, *Nerium oleander*, *Punica granatum*, *Pyracantha angustifolia* and *Rubus discolor* (pecan, persimmon, oleander, pomegranate, firethorn and Himalayan blackberry), all species that are capable of rapidly expanding along riparian corridors and with fruit that may be dispersed over long distances by birds. *Nerium oleander*, a very toxic evergreen shrub species native to stream banks and stream beds in the Mediterranean region, is especially dangerous as its seed is dispersed by wind and water and its natural habitat is the same as that required by California's sycamores, alders, willows and cottonwoods. The Sycamore Creek flora (35 spp., 1880 ft.) is being invaded by *Arundo donax* (giant reed), *Pyracantha angustifolia*, and *Tamarix*. The field survey crews observed evidence of recent

attempts to eliminate the *Arundo donax* population. The survey crews noted that *Malus sylvestris* (apple) appears to be spreading in Trauger's Creek (13 spp., 4573 ft.) and that the portion of the Kings River (6 spp., 4963 ft.) near Zumwalt Meadow (Cedar Grove) contained populations of *Poa pratensis*, *Bromus tectorum*, and *Cirsium vulgare*.

### Similarity of Exotic Species Composition Among Sites

To compare and contrast species composition among sites, an exploratory cluster analysis of the sites included in the species-richness-by-elevation figures was conducted using PC-ORD ver. 4 ([Figure 2](#)). Before the analysis was run, all species with occurrences at only one or two sites were excluded from the data matrix. In an analysis of sites with native species the low frequency species would have been left in the data matrix as indicator species. However, in the case of exotic species, the low frequency species are typically species that have not been widely dispersed and not species that are limited to a narrow set of environmental conditions. A variety of distance measures and group linkage methods were used to analyze the data and Euclidean distances combined with Ward's group linkage method produced the most interpretable clusters and the results are presented in [Figure 2](#).

An ecological interpretation of the factors that significantly affected the clustering of the exotic species is presented in [Table 1](#). Note that the sites with no exotic species have been added to the table as an unnumbered cluster. The coarsest division of the sites can be attributed to the presence of high species richness of low elevation species such as those commonly found in annual grasslands and blue oak woodlands. This result is expected because of the negative correlation between exotic species richness and elevation. When Euclidian distances are used as a measure of resemblance between sites based on species abundance or presence/absence data, a problem known as the double-zero effect may occur (Legendre and Legendre 1998). The problem arises because the algorithm for calculating the resemblance value using the Euclidian distance method does not differentiate between sites that share the same species and sites from which the same species are absent. For this reason the Euclidian distance method is generally recommended for comparing sites based on environmental factors and not recommended for comparisons based on species abundance or presence/absence data (Legendre and Legendre 1998). However, on close examination, that recommendation assumes that the analysis is being conducted to compare the results against the expectations of ecological niche theory. That theoretical test is not the purpose of the parks' exotic species surveys. The negative correlation of exotic species richness with increasing elevation resulted in the double-zero effect that is manifested in the close resemblance between the clusters of high elevation, exotic-species-poor sites in [Figure 2](#). Because Ward's method is an agglomerative hierarchical clustering technique, the first clusters are pair wise mergers of the most similar sites. Hence, the shorter the initial "legs" of the dendrogram in [Figure 2](#), the more closely the site pairs resemble each other. Therefore, because there are only a few species found at higher elevations, the double-zero effect results in a tendency for the higher-elevation sites to resemble each other because they lack many of the same species and the lower elevation sites to resemble each other because of the species they have in common. The next coarsest divisions are among xeric and mesic sites for sites rich in low-elevation species, sites that are dominated by mid and high elevation grass species with low forb diversity, and sites with a relatively high diversity of mid- to high-elevation forbs ([Table 1](#)).

The interpretation of clusters 1 through 5, sites rich in low-elevation species, is straightforward as indicated in [Table 1](#). All of the sites in those clusters range in elevation from 1300 ft. to 2800 ft. The sole exception to this elevational range is the Cedar Grove Pack Station at an elevation of 4701 ft. which is very rich in low-elevation species such as *Bromus diandrus*, *B. hordeaceus*, *B. madritensis*, *Erodium cicutarium* and *Lolium multiflorum* (ripgut brome, soft chess, red brome, red-stemmed filaree, red-stemmed filaree and Italian ryegrass).

Sites in cluster 6 are uniquely rich in low elevation annual grasses and also possess species that are common at mid elevations. Old Hidden Springs Trail at 2189 ft. in elevation is rich in low elevation annual grasses as expected and there are also mid elevation forb species at seeps and at stream crossings. The small corral at South Fork Campground (3728 ft.) may be responsible for the large number of annual



grasses found at the site. There is also a large number of annual grass species along the edges of Crystal Cave Parking Lot (4897 ft.).

Cluster 7 is composed of sites that range from 4500 ft. to 7500 ft. in elevation and are relatively poor in mid-elevation species and rich in annual grass species. *Bromus tectorum* and *Vulpia myuros* are constant annual grass species. The inclusion of Grant Grove Pack Station (6417 ft.) in the low-species-richness cluster is an artifact of sampling difficulties. The survey of that site was conducted after stock animals were placed in the corrals and many of the plants were either eaten or trampled beyond recognition. Cluster 8, Trauger's Creek (4573 ft.), is relatively rich in low-elevation species. However, neither *Bromus tectorum* nor *Vulpia myuros* are found at that site. That factor, in addition to the presence of mid-elevation species in seeps and at stream crossings and the presence of *Malus sylvestris*, accounts for the site's distinct cluster.

Clusters 9, 10 and 11 are notable for the presence of *Poa pratensis*. Sites in cluster 9, which range in elevation from 6000 ft. to 8500 ft., are relatively low in forb richness while *Taraxicum officinale* is characteristic of the sites in cluster 10, which range in elevation from 7000 ft. to 9000 ft. *Rumex acetosella* and *Spergularia rubra* are characteristic of sites in cluster 11 which range in elevation from 6500 ft. to 7500 ft. Hart Loop Trail (5506 ft.), a lower-elevation site, is included in this cluster because of the mid- and high-elevation species present at stream crossings and moist areas.

Clusters 12 and 13 are relatively rich in mid and high elevation forb species. The sites in cluster 12 range in elevation from 4500 ft. to 8000 ft. The low elevation Shepard Saddle Road site is the only exception, and it appears to be rich in mid and upper elevation forb species due to its proximity to Ash Mountain Corrals, Ash Mountain Shooting Range and Sycamore Creek. The sites in cluster 13 are at an elevation of 5500 ft. and include the adjacent Oriole Lake Dirt Road and Oriole Lake Meadow sites in addition to Mineral King Dirt Road. The forb species at these sites are species that are typically dispersed in the dung of stock animals. The sites near Oriole Lake are grazed by trespassing cattle from a nearby inholding, and the Mineral King Dirt Road site is adjacent to the Mineral King Pack Station.

Nearly all of the sites where no exotic species were found are above 8000 ft. The exception is Old Black Oak Trail at 5763 ft., a trail that has not been maintained for years. It is not clear why there are no exotic species present at the other five sites as *Poa pratensis* and *Taraxicum officinale* are present along the Rae Lakes Loop Trail to elevations of 9400 ft. and 9800 ft. respectively.

## YOSEMITE NATIONAL PARK

### Yosemite Survey and Quadrat Data

**1998 Field Methods** - During the summer of 1998, field crews began sampling three patch types (campgrounds, developments, and corrals) and two corridor types (trails and roads). Exotic species presence and cover estimates of exotic and native species were obtained from all patch types. While presence/absence data were recorded for each corridor type, cover along trails and roads was not estimated because the distribution of non-native plants along these linear landscape features was very patchy.

To conduct a survey, field crews compiled a complete list of plants in the study site. After making the list, the field crew placed each species into distribution classes and estimated the abundance of species on a log scale (0-10, 11-100, 101-1000, 1001-10,000, >10,000). Additionally, the distribution of each exotic species was characterized as scattered individuals, scattered clumps of individuals, large clumps of many individuals, or widespread throughout the area. Trails and road surveys sometimes continued for several kilometers and species presence data were recorded in 1 km segments along the length of each survey.

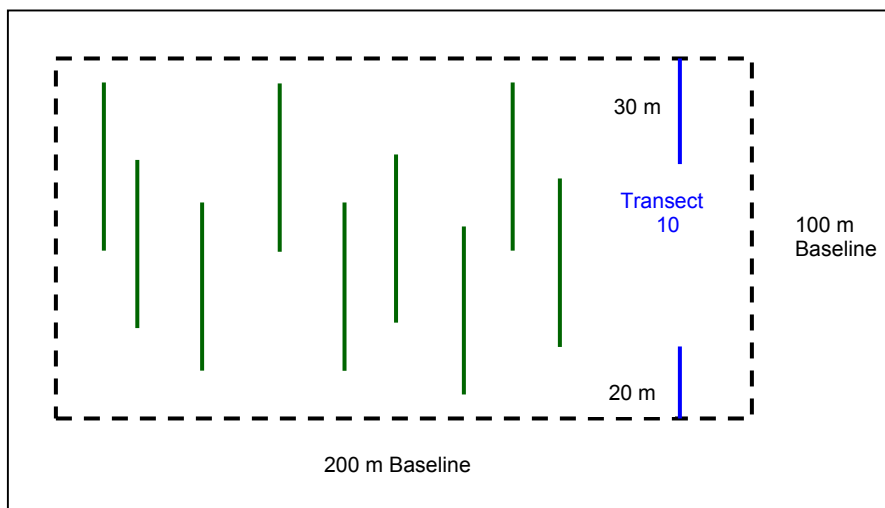
A baseline transect was established along one edge of each patch and a random number table was used to randomly place sampling transects perpendicularly along the length of the baseline transect. Quadrats (1 m<sup>2</sup>) were placed randomly along the sampling transects until thirty quadrats had been sampled. When thirty quadrats were sampled before the end of a sampling transect, the remainder of the sampling transect was also sampled to avoid biasing the data toward the beginning of the transect. In each quadrat, the cover of non-native and native plant species was estimated to the nearest one percent. The cover of a particular species could not exceed 100%, but the total of all species in the quadrat frequently exceeded 100%. Additionally, a natural vegetation control site was established in undisturbed vegetation 50 m from five of the campground sites.

As was the case in Sequoia-Kings Canyon NP, the sample sites frequently contained areas such as parking lots or tent pads that were inappropriate for sampling, so quadrats had to pass rejection criteria before field crews sampled them. Randomly placed quadrats were rejected if more than 50% of the cover was incapable of supporting plant life (pavement, dirt roads, large boulders and trampled areas within 1 m of a structure). Areas where exotics are cultivated (lawns, flower pots, gardens) also were rejected because exotic species are deliberately cultivated in them. If the crews rejected several quadrats, they added additional transects until 30 quadrats were sampled. In areas that were sampled for cover, the canopy cover of shrubs and trees was also recorded. Shrub cover along the length of transects was measured using the line intercept method. Field crews used periscopes to measure the presence or absence of tree canopy in the cross-hairs of the periscopes. At each site 100 canopy points were distributed at regular intervals along the transect. The data from the quadrat-based revealed little in the way of patterns in the data. Therefore, results from the quadrat data are limited to the species-richness-by-elevation figures below.

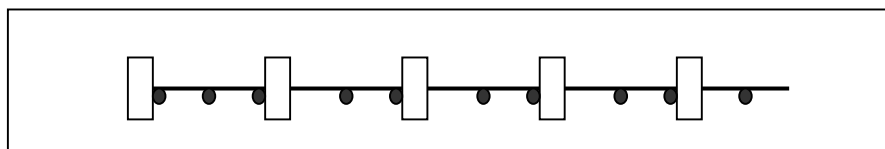
**1999 Field Methods** - The survey crews measured the distribution of exotic species in three types of patches (campgrounds, developments, corrals) and two types of corridors (trails and roads). Ten 50 x 2 m transects were randomly placed in each patch by establishing a baseline transect along one border (area length)(Figure 3a). The width of the target area was measured as a line perpendicular to the length, and a second baseline transect was established along the width border. Sampling transects were placed randomly along the two baseline axes. Whenever a sampling transect reached the boundary of a disturbed area or structure, the remainder of its sampling length was continued at the same position on the first axis and from the 0 position of the second axis (Figure 3a). At 10 m intervals beginning at meter 0, 2 m x 1 m quadrats were placed with the 2 m axis perpendicular to the sampling transect (Figure 3b). The cover of individual exotic species and the total cover of all native species were estimated in each quadrat. The total numbers of exotics and natives present in each sampling transect were also recorded. Canopy cover was measured every 5 m along each sampling transect using the point-intercept method with a hand-held periscope. Because some exotic species did not fall within the sampling transects, the entire sampling area was surveyed to compile a complete list of all exotic species present. Areas with

high densities of buildings or very few plants were not sampled, but surveyed only. The abundance of species in each patch was estimated on a log scale after the patch was surveyed.

Trails in Yosemite were sampled based on levels of use by hikers and recreational stock. The Yosemite National Park Wilderness Office supplied data on the number of backpacking wilderness permits issued on each trail, and the trails were grouped into three categories: low use (0-50 people/year), moderate use (51-1100 people/year) and high use (1101-6900 people/year). Seven trails were randomly selected for sampling from each use level. The Wilderness Office also supplied data on the number of stock using the trails in categories of low (3-10/day), medium (11-25/day), and high (26+/day). The concession stables provided route information for their daily rides in Yosemite Valley. Stock are only allowed on certain trails, and all trails open to stock use were sampled. The high use backpacking permit category contained the fewest number of trails, and most of these popular trails also received medium-high stock use. By comparison, low use backpacking permit trails had no stock use. No records were available for day-use by private stock parties on trails, so Mirror Lake Pack Trail and Yosemite Falls Trail had higher stock-use levels than indicated by the Wilderness Office data. Therefore, those trails were placed in the next higher stock-use category.



**Figure 3a.** Arrangement of 1999 transects in Yosemite National Park in campgrounds, developments and corrals that were sampled for exotic species. Two dimensions of the sample site were measured, and the transects were arranged randomly along the two axes. When a transect ran outside of the sample area, as in Transect 10, it was continued at the same position on the first axis and from the 0 position of the second axis.



**Figure 3b.** Sampling along 50 m transects. 1x2 m quadrats (rectangles) were placed every 10 m, and canopy cover was sampled every 5m (black points).

At each trailhead, the survey crews placed the first of ten 50 m X 2 m transects on the right side of the trail, one meter from the tread of the trail. Subsequent transects were placed on alternating sides of the trail and were begun across from the end of the previous transect. Transects were sampled using the same methods as were used to sample patches. After sampling within the transects, the field crews walked 3 km from the trailhead, recording all exotic species that occurred within 2 m of the trail in each kilometer. Abundances of exotic species were estimated in each trail segment on a log scale. Data from the quadrat-based sampling revealed little in the way of patterns among site types. However, results from the quadrat data are included in the richness-by-elevation figures and tables.

Roads were selected for sampling based on an elevational gradient. All roads in the park were categorized in 1000-ft. intervals between 3000 ft. and 8000 ft., and 1-km segments of road were mapped within the intervals. Five segments within each interval were randomly selected for sampling. Field crews



walked both sides of the road within the selected kilometer segments and recorded all exotic species within 3 m of the road shoulder. Abundances of exotic species were estimated in each road segment on a log scale. Coordinate locations for mapping survey areas and corridor segments were obtained from either a PLGR-type global positioning device or directly from USGS 7.5' quadrangles. The Jepson Manual: Higher Plants of California (Hickman 1993) was used to determine which plant species were not indigenous to the park.

## Yosemite NP Survey Results

The total number of exotic species encountered in Yosemite was 130. Species richness varied among 1 km road sections from one to 31, among 3 km trail segments from one to 26 and among corral/stable areas from two to 33 ([Table 2](#)). There was a range in species richness from one to 56 among 19 developments and a range in species richness from one to 57 among 19 campgrounds. A total of 99 different species were found among developments and 68 different species among campgrounds. Species richness ranged from 52 to 62 for all roads, all trails or all corral/stable areas combined.

## Decline of Exotic Species Richness with Increasing Elevation

**All sites** – As was found for Sequoia-Kings Canyon NP, graphs of site exotic species richness against site elevation indicate that exotic species richness is strongly negatively correlated with elevation when all sites are pooled ([Figure 4a](#)). This negative correlation is evident for each of the five site types when the graphs are restricted to particular site types ([Figures 4a-h](#)). Additionally, the graph of all sites suggests that the factors controlling exotic species richness change at an elevation of approximately 7000 ft. The graph also suggests that the factors are different at elevations below 5000 ft., but this pattern could be due to the large sampling effort at 4000 ft. and the gap in target sites between 2000 ft. and 4000 ft.

**Campgrounds/Camps** – Exotic species richness in campgrounds clearly is negatively correlated with elevation ([Figure 4b](#)). Additionally, the amount and type of use and site history apparently affect exotic species richness in campgrounds and camps at an elevation of approximately 4000 ft. The combined results of the 1998 and 1999 surveys recorded 56 exotic species at Lower River Campground (3860 ft.) which was closed after it flooded in 1997. This site had the greatest number of exotic species of any site surveyed and had 15 more exotic species than Yosemite Lodge which possessed the second highest exotic species richness in Yosemite Valley. The high species richness at Lower River Campground could be due to a flush of germination from the soil seed bank, local seed dispersal, long distance seed dispersal, reduced mortality due to the elimination of trampling by campers and the longer two-year sampling period. Four high use campgrounds, Wawona (24 spp., 2937 ft.), North Pines (24 spp., 4066 ft.), Lower Pines (21 spp., 3339 ft.), and Upper Pines (21 spp., 3950 ft.) constitute the group of active campgrounds with the highest exotic species richness. The three walk-in campgrounds, Hetch Hetchy (17 spp., 4100 ft.), Backpackers (11 spp., 4022 ft.), and Sunnyside (4 spp., 4022 ft.) possessed the lowest exotic species richness. There were very few exotic species at campgrounds or camps above an elevation of 6000 ft., and no exotic species were discovered in the control quadrats that were sampled outside the boundaries of five campgrounds. For Wawona Campground (see arrow in [Figure 4b](#)), this is a remarkable finding as the site lies within an elevational range that is highly invaded by exotic species. The site notes indicate that the control site was located 50 m north of the campground in an open canopy *Pinus ponderosa* (ponderosa pine) forest with *Calocedrus decurrens* (incense-cedar) and scattered *Quercus kelloggii* (California black oak) and a ground cover of *Chamaebatia foliolosa* (mountain misery).

**Roads** – The strong negative correlation between exotic species richness and elevation is evident from the survey of roadsides ([Figure 4c](#)). Exotic species richness also appears to be affected by site-specific characteristics. For example, the Yosemite Valley roads (Northside Drive adjacent to El Capitan Meadow and Southside Drive, 3958 ft.)(YV symbol) may be rich in exotic species because they contain both mesic and disturbed habitats while the Yosemite West (5969 ft.)(YW symbol) site may be species rich because it is a 3 km segment through a developed section of Ponderosa Way. Exotic species richness declined dramatically at elevations above 7000 ft. All road corridor sites below 5000 ft. were surveyed in 1998, road sites between 5000 ft. and 6000 ft. were surveyed in 1998 and 1999, and road corridors above 6000 ft. were surveyed in 1999. Therefore, differences between years may have been responsible for a minor part of the elevational effect. Additionally, there were no road surveys conducted at elevations below 4000 ft. [Appendix D](#) contains a complete exotic species list for all surveyed road segments.

**Trails** – The negative correlation between exotic species richness and elevation is evident in the graph of the data ([Figure 4d](#)). However, the strength of the negative correlation is much reduced if the heavily used Meadow Loop Trail (31 spp., 4053 ft.) and Yosemite Loop Trail (25 spp., 3972 ft.) are excluded from the graph. A summary of the 1998 survey data for trails is presented in [Table 3](#), a summary of the 1999 quadrat and survey data is presented in [Table 4](#), and a list of all exotic species discovered along trails is given in [Appendix E](#). *Bromus tectorum* is clearly the most common exotic species along trails in the park. While the level of trail usage appears to be important, it is not clear if exotic species richness is correlated with the use level of a trail by either hikers or pack animals or is due to the combined effect of both uses ([Tables 3](#) and [4](#)).

**Developments** – There is a very strong negative correlation between exotic species richness and elevation among developments ([Figure 4e](#)). Additionally, length of growing season may also be important along with site history (such as the amount of disturbance, the amount of seed dispersal, or both). For example, the points plotted at an elevation of approximately 4000 ft. comprise two groups. The species-rich sites (Foresta, Wawona, Yosemite Village, Yosemite Lodge, The Ahwahnee hotel) have either broad westerly exposure (former two) or southerly exposure (latter three) which lengthen the growing season. The relatively species-poor sites (Curry Village, Housekeeping, Mirror Lake) are in narrow, heavily-shaded sections of Yosemite Valley (due to canyon walls) with north to northwest exposures.

**Corrals/Stables** – The number of exotic species found at corrals and stables is negatively correlated with elevation ([Figure 4f](#)) and also appears to be influenced by local factors. The three corral/stable sites with the largest number of exotic species are, in descending richness, McCauley Ranch, Concession Stables (Yosemite Valley) and Hetch Hetchy Corral. Each is very close to 4000 ft. The sampling at Hetch Hetchy Corral extended through an annual grassland pasture, and the exotic species present are typical species found in annual grassland vegetation. However, McCauley Ranch and Concession Stables (Yosemite Valley) possess a diverse assemblage of annual grassland species, forage species and forage weeds and meadow species. The habitats at both sites are more diverse than the Hetch Hetchy Corral site as the Concession Stables (Yosemite Valley) survey included Lamon Meadow, and the McCauley Ranch survey included a marshy area. It is not clear why Wawona Stables, the next most diverse site, had relatively fewer species as the survey of that site also included an adjacent meadow. [Appendix F](#) contains a complete exotic species list for all surveyed corrals and stables.

The correlations between the exotic species floras of corrals and stables and the exotic species floras of the trails that lead from them are complex. The exotic species present along the low elevation Mirror Lake Pack Trail (3931 ft.) that begins at the Concession Stables (Yosemite Valley) all occur in the first 500 m of the trail ([Table 3](#)). The field description of the trail indicates that it runs through a shady stand of *Pinus ponderosa* and *Calocedrus decurrens* with little ground cover. The fact that the only exotic species along the trail are present at the beginning of the trail suggests that exotics are not spreading from the Concession Stables (Yosemite Valley). However, the species occurring along Snow Creek Trail, which runs through a stand of *Quercus chrysolepis* (canyon live oak) from the point where it connects with Mirror Lake Pack Trail, suggests that exotic species are being dispersed by pack animals. Three species that are commonly dispersed in horse dung (*Aira caryophylla*, *Bromus sterilis*, *Poa pratensis* [silver European hairgrass, poverty brome, Kentucky bluegrass]) and four species dispersed through stock-yard activities are present along Snow Creek Trail ([Appendix E](#) and [ESTA Species](#) Microsoft® Access database file). White Wolf Corral (7967 ft.) is a potential source of dung-dispersed species (*Poa pratensis*, *Trifolium repens*, *Rumex acetosella*) that are present at Harden Lake Corral (7496 ft.). However, the site history at Harden Lake Corral includes nearby homesteading and pasturing of pack-stock animals for lengthy periods to support nonrecreational wilderness trips. It is interesting that only one of these species was discovered along Harden Lake Trail (*R. acetosella*) and none along Lukens Lake Trail when both trails begin at White Wolf. This is despite the occurrence of *Poa pratensis* at higher elevations on the Young Lakes and Glen Aulin Trails. A similarly complex situation exists for the trails that begin near Tuolumne Concessions Stable which also supports *P. pratensis* and *T. repens*. Both of those species are present along Glen Aulin Trail and also at Glen Aulin High Sierra Camp. Only *P. pratensis* is found along the Young Lakes Trail, and neither species is found along either the section of the John Muir

Trail that leads toward the Vogelsang High Sierra Camp or at the camp. These inconsistent patterns may indicate that exotic plant establishment along trails leading from higher-elevation corrals and stables has been sporadic and opportunistic.

### Similarity of Exotic Species Composition Among Sites

To compare and contrast species composition among sites, an exploratory cluster analysis of the sites included in the species-richness-by-elevation figures was conducted using PC-ORD ver. 4. The same procedures were followed as those used to analyze the Sequoia-Kings Canyon NP data ([Figure 4](#)). An ecological interpretation of the factors that significantly affected the clustering of the exotic species is presented in [Table 5](#). Note that the sites with no exotic species have been added to the table as an unnumbered cluster. The coarsest division of the sites is due to sites with high exotic species richness that are found at low-, mid-, and high-elevations versus sites with moderate to low species richness. The double-zero effect is even more pronounced in the Yosemite NP analysis as the resemblance between pairs of sites increases consistently with altitude. The shorter the initial “legs” of the dendrogram in [Figure 4](#), the more closely the site pairs resemble each other. The next coarsest division among high-richness sites is between low-elevation sites (2000 ft.) at Rancheria and Old El Portal and sites that are at an elevation of approximately 4000 ft. For the moderate to low-richness sites, the next coarsest division is between mid-elevation sites (4000-7000 ft.) with mixtures of low-, mid-, and high-elevation species and higher-elevation sites (6000-10,000 ft.) with mixtures of mid- and high-elevation species. The sites between 4000 ft. and 7000 ft. can be divided into sites with a relatively high proportion of forb species and sites with a relatively high proportion of grass species.

Clusters 1 and 2 consist of high-richness sites with unique combinations of species at an elevation of approximately 4000 ft. Cluster 1 sites are primarily in Yosemite Valley and appear to possess species characteristic of mesic habitats as well as species characteristic of disturbed habitats. Cluster 2 sites are primarily in Wawona and Foresta, and species adapted to mesic conditions appear to be less common at those sites. Cluster 3 consists of Yosemite Valley sites with *Rubus discolor* and a high proportion of exotic perennial grasses. Cluster 4 sites are all low-elevation sites (2000 ft.) located in Rancheria and El Portal. These three sites are rich in species characteristic of annual grassland vegetation as well as many other species.

Cluster 5 sites are typically mid-elevation trails (4000-5500 ft.) lined with *Bromus tectorum* and *Vulpia myuros* and dotted with low and mid elevation forb species (See [Appendix D](#) for trail species lists). Cluster 6 consists of mid-elevation sites (6000-7000 ft.) with a high proportion of mid elevation forb species that are adapted to disturbed areas. Some characteristic species are *Spergularia rubra*, *Plantago major* and *Polygonum arenastrum* (sand-spurrey, common plantain and common knotweed). Cluster 7 consists of mid-elevation sites (4000-6000 ft.) that are relatively rich in exotic forb species. The ecological reason for the clustering of The Ahwahnee hotel and the Mirror Lake Pack Trail in this group is not clear except that they share several species in common with the other sites (*Poa pratensis* universally) and have a similar level of exotic species diversity. Cluster 8 consists of mid-elevation sites (4000-5000 ft.) with a high proportion of grass species.

Cluster 9 consists of mid- to high-elevation sites (6000-9000 ft.) which possess *Rumex acetosella* and *Spergularia rubra* and have a relatively high exotic species richness. Merced Grove Trail (4770 ft.) is an anomaly in this cluster, but the survey notes describe it as a combination dirt road and trail, and that may reflect differences in site history. Cluster 10 consists of high-elevation sites (7500-10,000 ft.) that possess a relatively high proportion of low-, mid- and high-elevation grasses. Finally, the sites with no exotic species are all high-elevation sites (7500-9500 ft.).

## Part III. Exotic Species Threat Assessment and Prioritization

### INTRODUCTION

All exotic species discovered during the directed surveys were grouped into one of four management priority categories based on their attributes, potential impacts, and geographical extent ([Tables 5](#) and [6](#)). **Category 1** species are exotics that are currently restricted to a relatively small number of sites in each park and have either been shown to greatly affect native vegetation or have a high probability of causing serious impacts. **Category 2** species are ones that generally have a lesser affect on native vegetation and are restricted to a relatively small number of sites. **Category 3** species are those that have been shown to have a great affect on native vegetation, are broadly distributed in the parks, and are apparently increasing their ranges within the parks. **Category 4** species are those that were detected by the surveys but not assigned to one of the three ranked categories and are considered low priority species. Complete listings of all priority exotic species and their survey locations are given in [Appendices A](#) and [B](#), and a complete listing of all exotic species in each park with important biological information is provided in the [ESTA Species](#) Microsoft® Access database file. The field notes of the Sequoia-Kings Canyon NP directed-survey team are provided in [Appendix C](#) for all priority exotic species. The assignments of exotic species to management categories were based on field assessments, the distribution of each species inside and outside of the parks, and information gleaned from the literature.

In addition to considering all published sources specific to particular exotic species, a large number of ecological, biological invasion, weed, botanical, agronomic, and range science sources were considered in the ranking of the exotic species. The most relevant sources are included in the “ESTA Bibliography.enl” EndNote® database file that has also been converted to a ProCite® database file (See the “convert.txt” file for instructions); either can be searched using the keyword field. Additionally, the “CalFlora Distribution Maps” directory contains all available state-wide distributions by county saved as image files from the CalFlora web site (CalFlora 2000). CalFlora is a comprehensive, web based, publicly accessible database of plant distribution information for California based on over 600,000 specific plant observations from disparate sources. All available CalFlora distribution maps for priority exotic species are included in [Appendix G](#). The “Control Methods” directory contains files from various sources that provide effective control measures for many exotic species (The Nature Conservancy 2000, Peirce 1998). The synthesis of this information provided a frame of reference to rank species for which there is little published data and to anticipate synergistic responses between species such as occurs in mixed swards of legumes and grasses.

The ranking of the exotic species into the three management categories provides general guidance for management prioritization in the parks. Category 1 species require immediate management action to isolate and eliminate their populations. In some cases the geographical distribution of a Category 1 species will dictate how management efforts are implemented. For example, in Yosemite NP, a few Category 1 species are found in Yosemite Valley and also at Wawona and Foresta. The highest control priority selected by park managers might be to eliminate those species from Yosemite Valley and to implement a management plan to prevent their spread in Wawona and Foresta. Category 2 species are predicted to have a lesser impact in the parks, but those predictions are based on very little data. At some park locations, Category 2 species can be eliminated along with Category 1 species without expending significant additional park resources. Category 3 dicot species cannot be eliminated without expending a significant amount of park resources while Category 3 grass species will be impossible to eliminate, and management efforts should focus on sites of great importance and on reducing seed dispersal.

Each exotic species has been assigned to a particular tactical class in addition to being ranked into the three management categories ([Tables 5](#) and [6](#)). The tactical classes organize exotic species with broadly similar ecological characteristics into classes that will require similar management techniques or approaches. There are other possible groupings of the exotic species in addition to the management categories and tactical classes. Four of the most important additional groupings consist of species that have been introduced to California to provide forage for animals, species that have been introduced and bred for use as turfgrasses, species that have evolved to invade grazing and forage-production systems and species intentionally introduced for horticultural reasons. Forage species and grazing and forage-

production invasive species constitute 55% of the 89 priority exotic species and other intentional introductions constitute another 39% for a total of 94% of all priority species. Certainly, many of the species in these three groupings are present in the parks because they have spread into the parks from their initial sites of introduction. Nevertheless, they illustrate the management importance of those groupings of species because controlled and uncontrolled access to the parks by domesticated grazing animals still occurs, and the introduction of additional horticultural species is still being considered.

Forage species represent a particularly important category of exotic species. Because of their economic importance for livestock production, they are continually being imported from Eurasia, hybridized, and selected for particular important traits by geneticists and plant breeders working for the United States Department of Agriculture, Agricultural Research Service, Rangeland, Pasture and Forages Program as well as scientists at many academic institutions. Unlike most horticultural species, many forage species are selected for their ability to establish and persist in natural plant communities as well as in human-modified environments. Many legumes and perennial grasses that have been introduced to increase forage production have become problem exotic species (Anonymous, Carrier and Bort 1916, Elliot 1949, Apfelbaum and Sams 1987, Tyser and Worley 1992, Grilz and Romo 1995, Blankespoor and May 1996, Harrison et al. 1996, Batcher 1999). Additionally, new varieties of exotic species that are known to invade natural areas are continually being imported (Dewey and Plummer 1980), and existing varieties are being bred for increased resistance to pathogens and pests as well as increased cold tolerance (Kehr et al. 1984, Asay et al. 1991, Rumbaugh et al. 1991). The continuous importation, breeding, varietal selection, seed certification and seed distribution programs that are related to the economic production of forage crop species may lead to dramatic changes in the invasiveness and dispersal distances of a forage species in the year certified seed is released to the public. For example, interactions between selected traits such as disease resistance and environmental factors such as minimum winter temperatures may potentially allow some forage species to expand their range into colder climates (Myers and Chilton 1941). Synergistic effects between forage species, such as legume and grass mixtures, may also lead to greater persistence of forage species in natural plant communities (Evans 1916, Looman 1976, Casler and Carlson 1995, Warren 2000). Also, under particular environmental conditions, many grass forage species may be toxic to herbivores due to endophytic *Clavibacter/Anguina* associations (McClay and Ophel 1993, Edgar 1994). Most scientific research on this issue has focused on domestic animal deaths but the toxin is known to greatly increase the frequency of abortions in sheep (McClay and Ophel 1993), and there is no information concerning its effects on wild herbivores. Finally, the climatic and geographical locations of the various forage species breeding programs in the western United States ensures that the parks are within the dispersal distance of forage species that are adapted to many different habitats and climates. Species adapted to northern-European-type climates are being bred in Oregon's Willamette Valley and near Pullman, Washington; species adapted to central Asian steppe and high altitude forest climates are being bred in Logan, Utah; and species adapted to Mediterranean-type climates are being bred in California. The distributions of adapted forage species are not random. Mediterranean type climate adapted forage species are grown west of the Sierra Nevada, steppe and high altitude forest adapted forage species are grown east of the Sierra Nevada, and northern European type climate forage species are grown in meadows and lower elevation logged forests throughout the western United States.

Turfgrass species used for golf courses and lawns are often the same species used in forage production systems but bred for different characteristics. Currently, there are a number of notifications filed with USDA-APHIS to release transgenic *Agrostis stolonifera* (creeping bent) and *Poa pratensis* cultivars that have been modified for glyphosate and glufosinate resistance. The stated intent of the developers of these transgenic cultivars is to reduce the amount of herbicides necessary to keep golf courses free of undesirable grasses such as *Poa annua* (annual bluegrass) (Neal 2000, Wipff and Rose-Fricker 2000). However, there is concern among some scientists in the turfgrass industry that the continuous use of glyphosate will select for glyphosate resistant perennial grasses (Neal 2000). Additionally, the only method for killing the resistant transgenic cultivars is to fumigate with methyl bromide which will be banned after 2005 (Neal 2000). Gene flow to closely-related species is also a serious concern as in one field test of transformed *A. stolonifera* where a marker gene was detected in untransformed plants at distances up to 298 m, and gene flow was predicted to have occurred up to a distance of 1,310 m from the transgenic plants (Wipff and Rose-Fricker 2000). Those researchers noted that *A. canina*, *A. capillaris*, *A. castellana*, *A. gigantea*, *A. stolonifera* and *A. vinealis* (velvet bent, colonial bent, highland



bent, giant bent grass, creeping bent and brown bent grass) freely hybridize and recommended that transgenic *A. stolonifera* seed not be produced until a male sterility system is developed (Wipff and Rose-Fricker 2000). The same company that sponsored the *A. stolonifera* transgenic research is now marketing glyphosate-resistant cultivars of *Festuca arundinacea* (tall fescue) and *Festuca trachyphylla* (hard fescue) that were developed through long term herbicide selection experiments (Rose-Fricker 2000). The development of glyphosate-resistant cultivars of these known invaders of riparian habitats means that they will be resistant to Rodeo<sup>®</sup>, one of the very few herbicides registered for use near riparian areas and wetlands. It is therefore absolutely critical that these cultivars not be introduced into the parks. Additionally, as *Poa pratensis* and *Agrostis gigantea* are dispersed in animal dung, all efforts should be made to stop seed dispersal into the parks by domestic animals. There are a number of other species that are now being promoted for use as turfgrass. The USDA-ARS at Logan, Utah, has released cultivars of *Agropyron cristatum* (crested wheatgrass) for turfgrass use in the Intermountain West; a European cultivar of *Koeleria macrantha* (junegrass) is being developed for dry and infertile soils and a European cultivar of *Festuca rubra* (red fescue) is being developed for damp and shady areas (Brede 2000). Cold-tolerant *Lolium perenne* (perennial ryegrass) is being bred to extend the climatic range of that turfgrass species (Ebdon 2000).

## PRIORITY EXOTIC SPECIES OTHER THAN GRASSES ([Table 6](#))

### Localized Wildland Species with Moderate to High Impact - Category 1 Species

***Carduus pycnocephalus*** (Italian thistle) is 0.2 to 2.0 m tall annual thistle that is ranked as a lesser invasive species by the California Exotic Pest Plant Council (CalEPPC 1999, [www.caleppc.org](http://www.caleppc.org)). Its CalFlora distribution indicates that this species is widespread in California (Appendix G) and its range in the Sierra Nevada appears to be increasing (Gerlach, personal observation). The distribution of *C. pycnocephalus* in the parks supports this observation. In Sequoia-Kings Canyon NP the only large population was discovered at the Ash Mountain Headquarters, and the remaining small populations are isolated and located in campgrounds, parking lots and in a streambed ([Appendix A](#)). In Yosemite NP it is present only at the closed Lower River Campground which supports a large number of exotic species ([Appendix B](#)). Unlike all other exotic thistles that are invading California's wildlands, *C. pycnocephalus* forms dense populations under tree canopies and ultimately excludes native species from those habitats. *C. pycnocephalus* seed is dispersed by adhering to animals and humans, by ants, as a contaminant in hay and soil, and by vehicles and wind (Ridley 1930, Evans et al. 1979, Pemberton and Irving 1990, Bossard and Lichti 2000). Its seed remains viable in the soil for more than 10 years (Parsons and Cuthbertson 1992).

***Centaurea maculosa*** (spotted knapweed) is a 0.2 to 1.2 m tall perennial thistle that is ranked as a red alert species by CalEPPC. Its CalFlora distribution indicates that numerous small populations exist in northern California (Appendix G). The directed surveys found it in Yosemite NP at Foresta. *C. maculosa* has the potential to invade meadows and open forests to an elevation of 3000 m. Its seed is dispersed by adhering to animals and clothing, by ants, in dung, as a contaminant in hay and feed pellets, in mud, and by vehicles and water (Watson and Renney 1974, Pemberton and Irving 1990, Wallender et al. 1995, Sheley et al. 1999). Its seed remains viable in the soil for more than 8 years (Davis et al. 1993).

***Centaurea solstitialis*** (yellow star-thistle) is a 0.1 to 2.0 m tall annual thistle that is ranked as one of the most invasive exotic species by CalEPPC. It is widespread in California but the largest populations are in central and northern valleys and foothills (DiTomaso and Gerlach Jr. 2000). *C. solstitialis* is extending its range into the central Sierra Nevada (DiTomaso and Gerlach Jr. 2000) but the upper altitudinal limits of its range are not yet known. Active management programs are in place at all three parks. The directed surveys found this species in Sequoia-Kings Canyon NP along the Generals Highway and at Swale Campground and in Yosemite NP at El Portal, Foresta, Hetch Hetchy Corral, McCauley Ranch and along Wawona Road. *C. solstitialis* seed is dispersed by adhering to animals and clothing, in contaminated hay

and soil and on vehicles and machinery (DiTomaso and Gerlach Jr. 2000). Its seed remains viable in the soil for more than 10 years (Calihan et al. 1993).

***Convolvulus arvensis*** (bindweed) is a twining perennial from deep, persistent roots that was considered but not listed as a serious invasive species by CalEPPC and which is ranked as a lesser invasive species by the Pacific Northwest Exotic Pest Plant Council (PNEPPC 1997, [www.wnps.org/eppclet](http://www.wnps.org/eppclet)). It is a noxious weed on arable lands and a problem exotic species in Yellowstone National Park (Anonymous 1992). Its CalFlora distribution indicates that it is widely distributed in California (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP at Potwisha Campground and in Yosemite NP at El Portal, McCauley Ranch and Yosemite Village. Its seed is dispersed in bird droppings, dung, hay and by machinery (Harmon and Keim 1934, Weaver and Riley 1982, Parsons and Cuthbertson 1992). Its seed remains viable in the soil for more than 20 years (Weaver and Riley 1982).

***Erigeron strigosus*** (tall fleabane) is a 0.3 to 0.8 m tall annual or biennial that has not been considered for ranking as an invasive species by CalEPPC. This species is native to the eastern United States and produces seeds asexually. Its CalFlora distribution indicates that there are only a few scattered populations in California (Appendix G), and the directed surveys found it in Yosemite NP only at The Ahwahnee hotel.

***Foeniculum vulgare*** (fennel) is a 1.0 to 3.5 m tall perennial herb from a thick taproot and is ranked as one of the most invasive exotic species by CalEPPC. Its CalFlora distribution indicates that it is widespread near the coast and suggests that it is invading the Central Valley and Mono County (Appendix G). The directed surveys found it in Yosemite NP only at Lower River Campground. *F. vulgare* seed is dispersed by adhering to animals and clothing, by ants, on vehicles and by water (Ridley 1930, Klinger 2000). It is an extremely difficult species to eradicate once it has established due to its large taproot and its enormous and long-lived seedbank (Klinger 2000). *F. vulgare* also forms large, dense populations that drastically alter the species composition and structure of grassland, riparian and wetland communities (Klinger 2000).

***Geranium robertianum*** (Robert's geranium) is a .01 to 0.5 m tall annual or biennial that is ranked as a red alert species by the Pacific Northwest Exotic Pest Plant Council (PNEPPC). Its CalFlora distribution indicates that it is present in Alameda, Sonoma, and Napa counties (Appendix G), and the directed surveys found it in Yosemite NP only at Lower River Campground. Its seed is adhesive (Ridley 1930) and is probably dispersed by adhering to animals, clothing and vehicles.

***Hypericum perforatum*** (Klamathweed, St. John's wort) is a 0.3 to 1.2 m tall perennial from a deep taproot and lateral rhizomes and is ranked as a lesser invasive species by CalEPPC. Its CalFlora distribution is primarily along the coast, in northwest California and in the northern Sierra Nevada (Appendix G). The directed surveys found this species only at a restricted number of locations in Yosemite NP (Appendix B). Biological control efforts have greatly reduced the size of many California populations but in Idaho, Oregon and Washington populations are still increasing in size despite the presence of biological control agents (Piper 1999). Biological control agents have not been effective in controlling *H. perforatum* in Australia (Parsons and Cuthbertson 1992). Despite the success of the biological control program in California, sustaining current levels of control requires a good habitat match for the biological control agents, that the agents remain unaffected by parasites or pathogens and that *H. perforatum* not adapt to the agents by becoming more resistant through natural selection. For these reasons it seems prudent that the control of *H. perforatum* should not depend exclusively on biological control agents. *H. perforatum* seed is dispersed by adhering to animals and clothing, in dung, and by machinery, vehicles and water. It also spreads vegetatively through the growth of rhizomes. Its seed remains viable in the soil for at least 10 years (Bellue 1945). *H. perforatum* is toxic to most herbivores (Fuller and McClintock 1986, Piper 1999).

***Marrubium vulgare*** (horehound) is a 0.1 to 1.0 m tall bushy perennial that was considered but not listed by the PNEPPC. It is one of the most widespread exotic plant species in the Mediterranean-type climate areas of southern Australia (Parsons and Cuthbertson 1992). Its CalFlora distribution indicates that it is widespread in California and suggests that it is now invading the foothills of the Sierra Nevada (Appendix G). The small number of populations discovered by the directed surveys, Buckeye Campground and

Potwisha Campground in Sequoia-Kings Canyon NP and El Portal, Happy Isles, and Lower River Campground in Yosemite NP, also suggests that this species is just beginning to invade the Sierra Nevada. In Sequoia-Kings Canyon NP, park maintenance workers report a marked increase in population size in recent years ([Appendix C](#)). *M. vulgare* seed is dispersed by adhering to animals and clothing and by horse dung (Ridley 1930, St John-Sweeting and Morris 1990). Its seed remains viable in the soil for at least 10 years (Weiss and Sagliocco 2000).

***Mentha pulegium*** (pennyroyal) is a 0.1 to 0.9 m tall bushy, stoloniferous perennial that is ranked as one of the most invasive exotic species by CalEPPC. Its CalFlora distribution indicates that it is common in coastal areas and suggests that it is invading the Sierra Nevada along river drainages ([Appendix G](#)). It was found only in Sequoia-Kings Canyon NP in the riverbed of the North Fork of the Kaweah River. The notes of the survey team state that dozens of plants were found in partly shaded, rocky and sandy places in and adjacent to the floodplain of the Kaweah River ([Appendix A](#)). All parts of the plant are toxic, and it has been used as an insect repellent (Fuller and McClintock 1986, Hickman 1993). Its seed is dispersed by adhering to animals and clothing; in cow dung; in contaminated hay, mud and soil and by vehicles, machinery and water (Parsons and Cuthbertson 1992, Warner 2000). It is also spread by the fragmentation of stolons that are subsequently transported by vehicles and water (Warner 2000).

***Mentha spicata*** (spearmint) is a 0.3 to 1.2 m tall bushy, stoloniferous perennial that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is common in California ([Appendix G](#)) but the directed-search data suggest that it may be invading the same habitats as *Mentha pulegium*. The directed surveys found it in Sequoia-Kings Canyon NP in the river bed of the North Fork of the Kaweah River and in Yosemite NP at The Ahwahnee hotel and at El Portal.

***Oxalis pes-caprae*** (Bermuda buttercup) is a 0.2 to 0.4 m tall rhizomatous perennial that requires more study according to CalEPPC. It is considered a noxious weed in many parts of the world. Its CalFlora distribution indicates that it is mostly confined to coastal areas and suggests that it is now invading the Sierra Nevada ([Appendix G](#)). It was found only in Sequoia-Kings Canyon NP in the Ash Mountain Developed Area and along the Generals Highway. *O. pes-caprae* forms dense populations that spread from rhizomes and bulbs which are dispersed in contaminated soil and on machinery (Parsons and Cuthbertson 1992, Peirce 1997). In Australia, most populations do not produce viable seed but there is no information about seed production in California. The failure to produce viable seed due to self-incompatibility has been overcome by extensive selfing in other self-incompatible species (Hiscock 2000), and this characteristic should not be relied upon to limit the spread of exotic species. *O. pes-caprae* is toxic to livestock (Fuller and McClintock 1986, Parsons and Cuthbertson 1992) and presumably to native herbivores also.

***Ranunculus parviflorus*** (smallflowered buttercup) is a 0.1 to 0.8 m tall annual that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is common in wet areas along the coast and suggests that it is now invading the Sierra Nevada ([Appendix G](#)). It is toxic although most herbivores will not eat it due to its bitter taste (Fuller and McClintock 1986).

***Ranunculus testiculata*** (buttercup) is a 0.01 to 0.1 m tall annual that has not been considered for ranking as an invasive species by CalEPPC. It is a widespread invasive species that has invaded *Bromus tectorum*-dominated grasslands throughout the Intermountain West, eastern Oregon, eastern Washington and Idaho (Young et al. 1992). Its CalFlora distribution indicates that it is present in Kern, Modoc, Mono and Lassen counties and strongly suggests that it is being dispersed by stock animals ([Appendix G](#)). Its seed is dispersed by adhering to animals (Young et al. 1992), and all parts of the plant are toxic although most herbivores will not eat it due to its bitter taste (Fuller and McClintock 1986, Young et al. 1992). Because it has proven its ability to invade stands of *Bromus tectorum*, it is likely that *R. testiculata* is capable of invading many habitats in all three parks where *Bromus tectorum* currently exists.

***Scorzonera hispanica*** (Spanish salsify, viper's grass) is a 0.3 to 1.0 m tall perennial that has not been considered for ranking as an invasive species by CalEPPC. This species is native to Europe, and it should be considered a potential invader of meadows and woodlands in California. Its CalFlora distribution indicates that it is present in Mendocino, Napa, Shasta and Sonoma counties ([Appendix G](#)).



The directed surveys found it in Yosemite NP at Lower River Campground and along the Inspiration Pt. Trail.

***Silybum marianum*** (milk thistle) is a 0.3 to 2.5 m tall, annual or biennial thistle that requires more study according to CalEPPC. Its CalFlora distribution indicates that this species is widespread in coastal areas and suggests that it is invading the Sierra Nevada (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP along Old Hidden Springs Road and in nearby Yucca Creek. This species invades areas with bare soil and produces dense populations that crowd out all other species and ensure that there is bare soil for germination in subsequent years (Parsons and Cuthbertson 1992). Its seed is spread by ants; in hay; and by machinery, water, and wind (Pemberton and Irving 1990, Parsons and Cuthbertson 1992). The Sequoia-Kings Canyon NP survey notes indicate that seed of this species is also dispersed in cow dung. Its seed remains viable in the soil for at least 9 years (Parsons and Cuthbertson 1992).

***Tamarix* spp.** (tamarisk, salt cedar) are 2.0 to 6.0 m tall many-branched shrubs or trees that are ranked as some of the most invasive exotic species by CalEPPC. The CalFlora distribution of *Tamarix* spp. indicates that they are expanding their ranges into riparian areas of the Central Valley (Appendix G). The directed surveys found these species only in Sequoia-Kings Canyon NP in the beds of the Kaweah River and Sycamore Creek. These species are dispersed by water and wind (Lovich 2000).

***Tragopogon dubius*** (yellow salsify, goat's beard) is a 0.3 to 1.0 m tall annual or biennial that is ranked as one of the most invasive exotic species by PNEPPC. Its CalFlora distribution indicates that it is widespread in northeastern California and is present in a couple of counties along the coast and also in Mono County (Appendix G). It is found in all three parks. In Sequoia-Kings Canyon NP, it is found in Halstead Meadow, Wolverton Pack Station, in developed areas and campgrounds, and along the Generals Highway ([Appendix A](#)). In Yosemite NP, it is found at McCauley Ranch and the Concession Stables (Yosemite Valley), in developed areas and campgrounds, and along trails and roads ([Appendix B](#)). Its seed is dispersed by water and wind (Ridley 1930, Kelley and Bruns 1975) and probably by adhering to animals. Its seed is viable in the soil for at least 2 years (Clements et al. 1999).

***Urtica urens*** (dwarf nettle, burning nettle) is a 0.1 to 0.6 m tall annual stinging nettle that has not been considered for ranking by CalEPPC. Its CalFlora distribution indicates that it is widespread along the coast and in southern California and suggests that it is spreading in central California (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP at the Ash Mountain Slash Pit, Cedar Grove Pack Station, Grant Grove Pack Station, Mineral King Pack Station and at Potwisha Campground. In Yosemite NP, it was found at the Government Stables (Yosemite Valley). Its seed is dispersed in the dung of many animals (Ridley 1930, Gray and Michael 1986, Malo and Suarez 1995) and is viable in the soil for over 5 years (Roberts and Feast 1972).

***Verbascum virgatum*** (wand mullein) is a 0.6 to 1.2 m tall biennial that has not been considered for ranking by CalEPPC. Its CalFlora distribution indicates that it has a widespread but very patchy distribution in California (Appendix G). It is present in Sequoia-Kings Canyon NP only at Azalea Campground, Lodgepole Developed Area, Red Fir Maintenance Yard, and Wuksachi. There is very little published information on this species but if it is similar to *V. thapsus* (woolly mullein) it will establish a large and long-lived seedbank.

### Localized Legumes with Moderate to High Impact - Category 1 Species

***Lathyrus latifolius*** (perennial sweet pea) is a robust sprawling or climbing perennial that has not been considered for ranking by CalEPPC. Its CalFlora distribution indicates that it is primarily distributed along the coast and suggests that it may be spreading in the Sierra Nevada (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area and in Traugers Creek and in Yosemite NP at El Portal, Wawona and Yosemite Village. The field notes describing the Traugers Creek area suggest that *L. latifolius* is a serious threat to riparian areas as the survey crew stated: "[t]housands of individuals in large, dense colonies were observed at the junction of the Mineral King Road and

Traugers Creek. A large colony is directly along the Mineral King Road and extends approximately fifty meters upstream from the road.” From these statements it appears likely that the invasion began upstream of the road and has spread downstream. There is no published information about the ecology of this species in wildlands.

***Medicago sativa*** (alfalfa, lucerne) is a 0.2 to 0.8 m tall tap-rooted or rhizomatous perennial that has not been considered for ranking by CalEPPC. It has been identified as a priority species in the Yellowstone NP area (Anonymous 1992). Its CalFlora distribution indicates that it is common along the coast and east of the Sierra Nevada and is sporadic in the Central Valley (Appendix G). It is certainly a common roadside plant along freeways and highways in the Central Valley (Gerlach, personal observation). The Central Valley populations are likely to be composed primarily of warm climate genotypes while the populations east of the Sierra Nevada are certainly composed of more cold tolerant and possibly stoloniferous genotypes that are a problem in the Yellowstone NP area (Lowe et al. 1972). The directed surveys found this species only in Sequoia-Kings Canyon NP along the flume in the Ash Mountain Developed Area and along the road at Milk Ranch. *M. sativa* seed is dispersed in feed pellets, hay and horse dung and moved by water (Ridley 1930, Kelley and Bruns 1975, Zamora and Olivarez 1994). Its seed remains viable in the soil for more than 20 years (Lewis 1973).

***Melilotus alba*** (white sweetclover) is a 0.5 to 2 m tall annual or biennial that is considered to be a lesser invasive by the PNEPPC. Its CalFlora distribution indicates that it is common along the coast and east of the Sierra Nevada, sporadic in the Central Valley, and perhaps invading the Sierra Nevada (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at the Cedar Grove Market and Lodge, Dorst Campground and Wuksachi and in Yosemite NP at El Portal, Hetch Hetchy Backpacker's Camp and Lower River Campground. *M. alba* seed is dispersed by adhering to animals and clothing, in dung and by water (Harmon and Keim 1934, Kelley and Bruns 1975, Turkington et al. 1978). Its seed remains viable in the soil for more than 30 years (Turkington et al. 1978).

***Melilotus indica*** (sourclover) is a 0.1 to 0.6 m tall annual that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is common in southern California, sporadic in the Central Valley, and perhaps invading the Sierra Nevada (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area and along the Generals Highway and Sycamore Creek. It was found in Yosemite NP at El Portal and Hetch Hetchy Backpacker's Camp. Its seed is viable in the soil for more than 5 years (Roberts and Feast 1972).

***Melilotus officinalis*** (yellow sweetclover) is a 0.5 to 2.0 m tall biennial that is considered to be a lesser invasive by the PNEPPC. It has been identified as a priority species in the Yellowstone area (Anonymous 1992). Its CalFlora distribution indicates that it is common along the coast and east of the Sierra Nevada, sporadic in the Central Valley, and perhaps invading the Sierra Nevada (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at Dorst Campground and in Yosemite NP at El Portal. *M. officinalis* seed is dispersed by adhering to animals and clothing (Turkington et al. 1978), and it is viable in the soil for more than 20 years (Turkington et al. 1978).

***Trifolium repens*** (white clover) is a creeping perennial that roots from stolons and has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is present in most of California (Appendix G). The directed surveys found this species at several locations in both park areas, but the number of individuals in each population was relatively small. Its seed is dispersed by adhering to animals and clothing, in bird droppings and dung, in mud and by vehicles (Ridley 1930, Dore and Ranmond 1942, Gillham 1970, Welch 1985, Mt. Pleasant and Schlather 1994, Malo and Suarez 1995, Fischer et al. 1996, Hodgkinson and Thompson 1997). Its seed is viable in the soil for more than 20 years (Toole and Brown 1946).

***Vicia benghalensis*** (purple vetch) is a sprawling or climbing annual that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is common along the coast and in some parts of the Sacramento Valley (Appendix G). The directed surveys discovered it in Yosemite NP at El Portal and in Sequoia-Kings Canon NP along Old Hidden Springs Road where a large population is spreading into the adjacent grassland.

***Vicia sativa*** (common vetch) is a sprawling or climbing annual that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is common along the coast and in some parts of the Sacramento Valley and suggests that it is spreading in the Sierra Nevada (Appendix G). The directed surveys discovered it in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area and along the Generals Highway.

***Vicia villosa*** (hairy vetch, winter vetch) is a sprawling or climbing annual that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is widely distributed in California (Appendix G). The directed surveys discovered it in Sequoia-Kings Canyon NP along the Generals Highway. Its seed is dispersed in bird droppings, dung and mud (Aarssen et al. 1986).

### Localized Fruit and Nut Species With High Impact - Category 1 and 2 Species

***Carya sp.*** (pecan) is a 20 m tall deciduous nut tree that has not been considered for ranking as an invasive species by CalEPPC. Its seed is probably dispersed by animals and water. The directed surveys found one mature tree in Sequoia-Kings Canyon NP at Grunnigan Ranch in a field bordering Yucca Creek.

***Diospyros sp.*** (persimmon) is a 10 m tall deciduous fruit tree that has not been considered for ranking as an invasive species by CalEPPC. Its seed is probably dispersed by animals and water. The directed surveys found a stand of vegetatively reproducing trees in Sequoia-Kings Canyon NP at Grunnigan Ranch in a field bordering Yucca Creek.

***Ficus carica*** (edible fig) is a 7 m tall deciduous fruit tree that is ranked as one of the most invasive exotic species by CalEPPC. Its CalFlora distribution indicates that it is common in southern California and in the Sacramento and San Joaquin Valleys (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP in the North and Middle Forks of the Kaweah River and in Yucca Creek. *F. carica* forms dense thickets in riparian forests and streamside habitats and is very difficult to eradicate (Randall 2000). Its seed is dispersed in bird droppings and dung (Debussche and Isenmann 1994, Lisci and Pascini 1994) and probably by water. The seed will germinate only after it has passed through the gut of an animal or has been abraded by washing over rough surfaces (Lisci and Pascini 1994).

***Juglans californica*** (California black walnut) is a 20 m tall deciduous nut tree that is native to California but is not native to any of the park s. The directed surveys found this species in Sequoia-Kings Canyon NP in Yucca Creek. The notes of the survey crew suggest that a single tree from a residual planting is creating a population of seedlings in Yucca Creek. It is wind pollinated and its seed is dispersed by animals and water. It is also know to hybridize with *Juglans regia* (English walnut) (Hickman 1993) which is also growing nearby in Yucca Creek.

***Juglans regia*** (English walnut) is a 20 m tall deciduous nut tree that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates a patchy distribution in southern and central California (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP in Yucca Creek. The notes of the survey crew suggest that it exists as a single tree from a residual planting. It is wind pollinated and its seed is probably dispersed by animals and water. It is also know to hybridize with *Juglans californica* (California black walnut) (Hickman 1993) which is growing nearby in Yucca Creek.

***Malus sylvestris*** (apple) is a 7 m tall deciduous fruit tree that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates a patchy distribution in southern and central California (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP in Traugers Creek. The notes of the survey crew suggest that a single tree from a residual planting is creating a population of seedlings in Traugers Creek. Its seed is dispersed by animals and water.

***Morus alba*** (white mulberry) is a 10 m tall deciduous fruit tree that is considered to be a lesser invasive by the PNEPPC. Its CalFlora distribution indicates a patchy distribution California (Appendix G). The

directed surveys found *M. alba* in Sequoia-Kings Canyon NP along the Colony Mill Road in a stream bed and in the stream bed of the Middle Fork of the Kaweah River. The seed of this species is dispersed in bird droppings (Ridley 1930, Debussche and Isenmann 1994) and probably by water.

***Olea europaea*** (olive) is a 7 m tall evergreen fruit tree that has not been considered for ranking as an invasive species by CalEPPC. It is a highly invasive species in the Mediterranean-type climate areas of Australia. Its CalFlora distribution indicates that it has escaped from cultivation in southern California and in the Sacramento and San Joaquin Valleys (Appendix G). The directed surveys found a stand of trees in Sequoia-Kings Canyon NP at Grunningan Ranch growing along Old Hidden Springs Road. The seed of *O. europaea* is dispersed in bird droppings (Ridley 1930, Debussche and Isenmann 1994).

***Prunus persica*** (peach) is a 7 m tall deciduous fruit tree that has not been considered for ranking as an invasive species by CalEPPC. The directed surveys found this species in Sequoia-Kings Canyon NP in the Crystal Cave parking lot. The survey notes indicate that two trees were residual plantings and two were saplings from seed. The seed of this species is probably dispersed by animals and humans.

***Punica granatum*** (pomegranate) is a 5 m tall deciduous fruit tree that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it has a patchy distribution in southern California and in the San Joaquin Valley (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP along a footpath leading from the Ash Mountain Developed Area to the Kaweah River and at Grunningan Ranch. Its seed is probably dispersed by animals and humans.

***Rubus discolor*** (Himalayan blackberry) is an arched bramble that is ranked as one of the most invasive exotic species by CalEPPC. Its CalFlora distribution indicates that it is widely distributed in California (Appendix G). The directed surveys found it in Sequoia-Kings Canyon NP at the Giant Forest Sewage Plant, Grunningan Ranch, Potwisha Campground and in Redwood Creek, Yucca Creek and the Kaweah River. In Yosemite NP it was found at El Portal, McCauley Ranch, Wawona and multiple locations in Yosemite Valley. Its seed is dispersed in bird droppings, dung and water (Parsons and Cuthbertson 1992, Hoshovsky 2000).

***Rubus laciniatus*** (cut-leaved blackberry) is an arched bramble that is considered to be a lesser invasive by the PNEPPC. Its CalFlora distribution indicates that it has a patchy distribution along the north coast and in the Central Valley (Appendix G). The directed surveys found this species in Yosemite NP at Lower Pines Campground, North Pines Campground, Wawona Campground, and along the Meadow Loop Trail in Wawona. The seed of this species is probably dispersed in bird droppings, dung, and water.

***Vitis vinifera*** (cultivated grape) is a woody vine that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it has escaped cultivation along the coast and in the Central Valley (Appendix G). The directed surveys found *V. vinifera* in Sequoia-Kings Canyon NP growing in frequent dense patches in Yucca Creek and in Yosemite NP at the Wawona Campground and in Yosemite Village. *V. vinifera* seed is dispersed in bird droppings (Ridley 1930, Debussche and Isenmann 1994) and probably by water.

### Localized Ornamentals With High Impact – Category 1 Species

***Ampelopsis arborea*** (peppervine) is a climbing deciduous vine with twining tendrils that has not been considered for ranking as an invasive species by CalEPPC. ). This species is established at Ash Mountain in Sequoia NP. Its seed are probably dispersed by birds.

***Catalpa bignoides*** (common catalpa, Indian bean) is a 10 m tall deciduous tree that has not been considered for ranking as an invasive species by CalEPPC. This species is an ornamental, not yet naturalized, at Ash Mountain in Sequoia NP. Its seeds are probably dispersed by animals and water..

***Cistus* sp.** (rock-rose) is a 1 m tall evergreen shrub not yet considered for ranking as an invasive species by CalEPPC. This species is an ornamental, not yet naturalized, at Ash Mountain in Sequoia NP.

***Coreopsis lanceolata*** (garden coreopsis) is a 0.3 to 0.6 m tall perennial that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it has escaped cultivation in Butte, Santa Cruz, and Sonoma Counties (Appendix G). The directed surveys found this species at El Portal in Yosemite NP. The description of the seeds of this species in Hickman (1993) suggests that its seed is dispersed by adhering to animals and clothing.

***Digitalis purpurea*** (purple foxglove) is a 0.2 m tall perennial that is considered to be a lesser invasive by the PNEPPC. Its CalFlora distribution indicates that it has escaped cultivation along the coast and in the foothills bordering the Sacramento Valley (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at Cold Springs Campground, Giant Forest Developed Area in Eli's Paradise meadow, Grant Grove Developed Area in the forest, Lodgepole Developed Area, and at the former site of the Sunset Campground. This species was found in Yosemite NP at Wawona. *D. purpurea* is extremely toxic (Fuller and McClintock 1986) and skin contact as well as smoke from burning leaves has caused injury to workers on control projects (Harris 2000). Its seed is dispersed in mud, wind, and vehicles (Hodkinson and Thompson 1997) and it remains viable in the soil for more than 5 years (Harris 2000).

***Eucalyptus citriodora*** (lemon-scented gum) is a 30 m tall tree that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it has escaped from cultivation in San Diego County (Appendix G). This species is present in Sequoia-Kings Canyon NP at the Ash Mountain Park Boundary. The notes of the survey team indicate that the single tree at the site had been cut down but was stump sprouting. This seed of this species is dispersed by wind.

***Genista monspessulana*** (French broom) is a 3 m tall evergreen shrub that is ranked as one of the most invasive exotic species by CalEPPC. Its CalFlora distribution indicates that it is widespread along the coast and suggests that it is invading the areas around the Central Valley (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area. The survey notes indicate that control efforts were in progress and that most plants appeared to be seedlings. All parts of this species are toxic (Hickman 1993). The seed of *G. monspessulana* is dispersed by ants, machinery, and water and in bird droppings and mud (Pemberton and Irving 1990, Bossard 2000). Its seed remains viable in the soil for over 5 years (Bossard 2000).

***Hedra helix*** (English ivy) is an evergreen woody vine or shrub that is ranked as a lesser invasive species by CalEPPC and is ranked as one of the most invasive exotic species by the PNEPPC. Its CalFlora distribution indicates that it has escaped in many coastal counties and in the Sacramento Valley (Appendix G). The berries, leaves and sap of *H. helix* are toxic (Fuller and McClintock 1986). It is present in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area and in Yosemite NP at Yosemite Village. Its seed is dispersed in bird droppings (Gillham 1970, Debussche and Isenmann 1994).

***Heteromeles arbutifolia*** (toyon) is a 5 m tall shrub or small tree that is native to California but is not native to the Kaweah River drainage. The notes of the survey crew indicate that it is naturalizing from plantings about the Ash Mountain Developed Area in Sequoia-Kings Canyon NP. Its seed is dispersed in bird droppings.

***Iris*** sp. (iris) is a herbaceous perennial that spreads by seeds and vegetatively. The survey crew found a species of *Iris* escaping in the Lodgepole Developed Area of Sequoia-Kings Canyon NP. One plant was growing on the north side of the river on a steep slope adjacent to a large asphalt parking lot and another was found growing adjacent to a deserted government residence.

***Leucanthemum maximum*** (Shasta daisy) is a 0.3 to 0.7 m tall rhizomatous perennial that has not been considered for ranking as an invasive species by CalEPPC. Its CalFlora distribution indicates that it is escaping along the north coast and in the Sacramento Valley (Appendix G). In Hickman (1993) it is described as spreading locally and that it is morphologically similar to *L. vulgare*. The directed surveys found this species in Yosemite NP at Yosemite West. The leaves of this plant are toxic and can cause contact dermatitis (Fuller and McClintock 1986).

***Leucanthemum vulgare*** (ox-eye daisy) is a 0.2 to 0.5 m tall rhizomatous perennial that is ranked as a lesser invasive species by CalEPPC and is ranked as one of the most invasive exotic species by

PNEPPC. Its CalFlora distribution indicates that it is widespread in the northern half of the state (Appendix G). The directed surveys found it in Yosemite NP at Foresta, North Pines Campground, Concession Stables (Yosemite Valley), Wawona, and Yosemite Lodge. *L. vulgare* seed is dispersed by adhering to animals and clothing, and in dung, hay, and wildflower seed mixes (Horthwath and Williams 1968, Fischer et al. 1996, Olsen and Wallander 1999). Its seed remains viable in the soil for at least 39 years (Toole and Brown 1946).

***Leucojum aestivum*** (summer snowflake) is a 0.5 m tall perennial that has not been considered for ranking as an invasive species by CalEPPC. The partial information provided by an abstracting service (CAB Abstracts) suggests that it is escaping cultivation in the northeastern U. S. but the referenced source material was not available. The description of *L. aestivum* in the Sunset Western Garden Book (Hogan 1992) states that it naturalizes under deciduous trees, in orchards and on cool slopes. The directed surveys discovered it escaping in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area. The survey notes state: “[h]undreds of plants grew about the Research Center in unwatered flowerbeds and in adjacent unwatered grassy areas. This species appears to reproduce sexually and asexually in this area.”

***Ligustrum sinense*** (Chinese privet) is a 7 m tall shrub or tree that requires more study according to CalEPPC. It is widely naturalized across the central and eastern U. S. and is a problem species in many nature preserves (Batcher 2000). The directed surveys found dozens of *L. sinense* hedges in Sequoia-Kings Canyon NP growing about the Ash Mountain Developed Area. The seed of this species is dispersed in bird droppings and by water (Batcher 2000).

***Nerium oleander*** (oleander) is a 4 m tall evergreen shrub that was considered but not ranked as an invasive species by CalEPPC. The directed surveys found a residual planting of this species in Sequoia-Kings NP at the Grunnigan Ranch near Yucca Creek. In California there is a widespread misperception that this species is adapted to dry conditions. In its native Mediterranean region *N. oleander* is an obligate riparian species that establishes on stream banks and on sandbanks in streambeds (Herrera 1991). In some areas in Sacramento County roadside populations of *N. oleander* are colonizing drainage ditches (Gerlach, personal observation). All parts of this species are very toxic (Fuller and McClintock 1986). Its seed is dispersed by water and wind (Herrera 1991).

***Pyracantha angustifolia*** (firethorn) is a 4 m tall evergreen, thorny shrub that requires more study according to CalEPPC. Its CalFlora distribution indicates that it is escaping in coastal areas north of the San Francisco Bay (Appendix G). The directed surveys found this species naturalizing in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area, Grunningan Ranch, Middle Fork of the Kaweah River and Sycamore Creek. The seed of this species is dispersed in bird droppings and in water (Ridley 1930, Debussche and Isenmann 1994).

***Rudbeckia hirta*** (bristly coneflower, black-eyed susan) is a 0.3 to 0.8 m tall annual to short-lived perennial that has not been considered for ranking as an invasive species by CalEPPC. This species is native to the prairies of the Midwestern United States (Hickman 1993) and should be considered a threat to escape and invade meadows in California. Its CalFlora distribution indicates that it is escaping from cultivation in the Central Valley (Appendix G). The directed surveys discovered this species in Yosemite NP at The Ahwahnee hotel.

***Spartium junceum*** (Spanish broom) is a 5 m tall shrub or tree that is ranked as a lesser invasive species by CalEPPC. Its CalFlora distribution indicates that it has naturalized along the coast and in the Sacramento Valley (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area, along the Generals Highway and in the Middle Fork of the Kaweah River. The survey notes indicate that the Kaweah River population is periodically cut back by Park personnel. Its seed is dispersed by ants and water and is viable in the soil for more than 5 years (Nilsen 2000).

***Tanacetum parthenium*** (feverfew) is a 1.0 m tall perennial that is ranked as one of the most invasive exotic species by the PNEPPC. Its CalFlora distribution indicates that scattered populations are widely distributed about the state (Appendix G). The directed surveys found this species in Sequoia-Kings Canyon NP at the Grant Grove Developed Area and in Yosemite NP at Wawona. This species is probably

toxic and may cause contact dermatitis. Its seed is dispersed in mud and on vehicles (Hodkinson and Thompson 1997).

***Vinca major*** (greater periwinkle) is a sprawling shrub that roots at shoot nodes and has been ranked as a lesser invasive species by CalEPPC. Its CalFlora distribution indicates that it has escaped from cultivation along the coast and in the Sacramento Valley (Appendix G). The directed surveys found this species in Sequoia NP at the Ash Mountain Developed Area, along the Generals Highway, and in Potwisha Campground. It was discovered in Yosemite NP at El Portal. This species is very difficult to eradicate and has caused problems in many natural areas and frequently invades moist, shady habitats (Bean and Russo 1988). In California it appears to be self-incompatible and to spread only from stem or root fragments (Bean and Russo 1988). The failure to produce viable seed due to self-incompatibility has been overcome by extensive selfing in other self-incompatible species (Hiscock 2000), and this characteristic should not be relied upon to limit the spread of exotic species.

## PRIORITY EXOTIC GRASS SPECIES ([Table 7](#))

### Category 1 Species

***Agrostis gigantea*** is ranked as one of the most invasive exotic species by the Pacific Northwest Exotic Pest Plant Council (PNEPPC). Its CalFlora distribution is primarily along the north coast and northern Sierra and the outlier collections indicate that it can expand its range greatly in California (Appendix G). Currently, *A. gigantea* is known from Yosemite NP but the survey notes indicate that it may also be present in Sequoia-Kings Canyon NP at the Columbine Picnic Area and in streams in the Grant Grove area near Wilsonia. In Yosemite NP its distribution is limited to Yosemite Valley, Wawona, and Foresta although directed surveys of riparian areas might identify other populations. It is a 0.2 to 1 meter tall cool-season perennial grass with rhizomes up to 0.25 meter long that form an open sod over time. The typical habitats it invades are ditch banks, riparian areas and wet meadows which it dominates through vegetative reproduction and seedling recruitment. It is dispersed in cow dung (Dore and Ramond 1942, Welch 1985) and probably in the dung of other animals and by water. The soil under established populations contains a large and moderately persistent seed bank (Bekker et al. 2000). The literature contains no control methods appropriate for natural riparian areas and wet meadows. However, because this is an important forage species there is quite a lot of information about its biology in the literature (Anonymous 1972, Fergus and Buckner 1973, Alderson and Sharp 1995). Mechanical eradication is likely to be difficult and because of its association with wet habitats herbicide choices are very limited. Flaming with backpack units may be an option because of the reduced fire hazard in wet areas. If the species morphology and phenology are similar to other exotic perennial grasses then management treatments during the boot stage are likely to be the most successful.

***Arundo donax*** (giant reed) is ranked as one of the most invasive exotic species by the California Exotic Pest Plant Council (CalEPPC) and in some counties the species occupies nearly every drainage system (Kelly 1999). Its CalFlora distribution is widespread in southern California and in northern California it is found primarily in the coastal ranges, the Sacramento Valley and the foothills of the Sierra Nevada (Dudley 2000) (Appendix G). Currently, it appears to be expanding its range in the foothills of the southern Sierra Nevada. During the directed surveys *A. donax* was found only in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area and in Sycamore Creek. The notes of the survey crew indicate that some eradication work was being carried out on the Sycamore Creek population in 1997. *A. donax* is a 2 to 5 meters tall, erect, perennial cane- or reed-like grass, with creeping rhizomes that spread to form very dense stands (Dudley 2000). Interestingly, very little is known about the biology of this species which has been used by humans for over 5000 years (Hoshovsky 1986). As *A. donax* appears to reproduce only through the dispersal of rhizomes down stream or down slope, successful control requires that surveys be conducted upstream or up slope of all known populations to ensure that the site is not reinvaded (Stein and Vartanian 1997, Kelly 1999). Control techniques have been developed by the CalEPPC Team Arundo groups and Team Arundo del Norte can be contacted through Tom Dudley (510) 643-3021 or [tdudley@socrates.berkeley.edu](mailto:tdudley@socrates.berkeley.edu).

***Bromus inermis*** (smooth brome) is ranked as one of the most invasive exotic species by the PNEPPC. Its CalFlora distribution is primarily in northeastern California, and it appears to be expanding its range in central California (Appendix G). Currently, *B. inermis* is found only in Yosemite NP, and its distribution is restricted to the southwestern portion of the park, Curry Village and Crane Flat. Because this species has only recently extended its range to central California, there is no information about its ability to invade park plant communities. However, its ability to invade and dominate similar plant communities is well established (Sather 1987, Tyser and Worley 1992, Grilz and Romo 1995, Willms and Quinton 1995, Blankespoor and May 1996). Also, because it is an important forage species, its habitat requirements have been well documented (Oakley 1924, Newell 1973, Looman 1976, Miller and Krueger 1976, Dewey and Plummer 1980, Miller et al. 1981, Casler and Carlson 1995, Vogel et al. 1996). *B. inermis* is a 0.5 to 1 meter tall, dense sod-forming, perennial cool-season grass that spreads from seed and rhizomes. It is more drought tolerant than other exotic cool-season grasses and is also more tolerant of higher summer temperatures (Jung and Baker 1973). Some populations of *B. inermis* may become sod bound, but, if the species is growing in a mixture with legumes such as *Medicago sativa* (alfalfa) or *Trifolium repens*, the population will remain highly productive indefinitely (Casler and Carlson 1995). In addition to its ability to dominate native vegetation, *B. inermis* also may be a threat to the genetic identity of native perennial *Bromus* species. *B. inermis* has been shown to form fertile hybrids with *B. pumpellianus* in the Rocky Mountains (Elliot 1949) and new introductions of diploid genotypes by the U.S.D.A. (Dewey and Plummer 1980) might increase the risk of hybridization with native perennial *Bromus* species. Control of *B. inermis* can be very difficult once it has established within stands of native grasses. However, its populations can be reduced through close mowing in early spring and late fall (Casler and Carlson 1995). Additionally, its rhizomes are not perennial and new rhizomes are initiated each spring from over-wintering shoots which can be killed by cutting them just below the soil surface in late fall (Oakley 1924). This morphological peculiarity may also render it susceptible to flaming in late fall when fire hazards are low.

***Dactylis glomerata*** (orchard grass) is considered to be a lesser invasive by the PNEPPC. However, the forage and rangeland literature suggests that it has not been sown as a mid elevation range forage as widely as other exotic cool-season grasses (Jung and Baker 1973). Also, along with *Phleum pratense* (cultivated timothy), it is one of the most sought after grass species by cattle (Miller and Krueger 1976) and so may be somewhat limited by preferential grazing. *D. glomerata* is a 1 to 1.3 meter tall, cool season, open sod forming, perennial grass that forms dense populations than can persist for at least 20 years in competition with *Poa pratensis* (Tsuyuzaki and Kanda 1996). It can also tolerate much lower light levels than other exotic perennial grass species (van Santen and Sleper 1996). Finally, the phenologies of the two major genotypes, northern European and Mediterranean, are very different. The northern European genotype is winter dormant and summer active while the Mediterranean genotype is winter active and summer dormant (van Santen and Sleper 1996). All of these factors suggest that the range expansion of *D. glomerata* has been dispersal limited and that the species is capable of dominating mesic, mid-elevation habitats in the parks. Its CalFlora distribution indicates that it is widely distributed in California (Appendix G). In Sequoia-Kings Canyon NP it is found at the Ash Mountain Developed Area, at the Columbine Picnic Area on a stream bank, Giant Forest Developed Area, Eli's Paradise Meadow, Round Meadow and Lodgepole Developed Area. It is found in Yosemite NP throughout the Yosemite Valley and also at Tuolumne Concessions Stables, Merced Grove, Foresta, Wawona, Big Oak Flat Road and Tioga Road. A directed search of meadows and riparian areas will probably locate more populations. Shady meadows or riparian areas may be particularly susceptible to invasion by the northern European genotype. This means that it is particularly important to prevent the introduction of seed from areas where the northern European genotype has been sown – irrigated pastures in the foothills of the Sierra (Raguse et al. 1967) and rangeland and irrigated pastures in Idaho, Nevada, Oregon, and Washington. *D. glomerata* seed is dispersed by adhering to animals, floating on water, in cow dung (Ridley 1930, Kelley and Bruns 1975, Schmida and Ellner 1983, Mt. Pleasant and Schlather 1994, Fischer et al. 1996) and probably horse dung. *D. glomerata* is very responsive to increased levels of soil potassium and nitrogen and does especially well growing in mixtures with *Medicago sativa* or *Trifolium repens* (van Santen and Sleper 1996). *Festuca arundinacea* and *Poa pratensis* are only able to compete with it when nitrogen and potassium are limiting (Jung and Baker 1973). Its seed persists in the soil for at least 4 years (Lewis 1973). Its leaves support fungal endophytes (van Santen and Sleper 1996) but there are no reports in the literature implicating the alkaloids produced by the endophytes with animal health disorders as occurs when infected *Festuca arundinacea* is grazed. Nothing has been published on the control of *D. glomerata* and herbicide options will be very limited for populations growing in riparian areas.



***Festuca arundinacea*** (tall fescue) is ranked as a lesser invasive species by CalEPPC. Its CalFlora distribution is primarily in coastal areas and in the Feather River and American River watersheds (Appendix G). It is found in Yosemite NP at Lower River Campground and in Sequoia-Kings Canyon NP at the Ash Mountain Developed Area, Dorst Campground and along Cedar Grove Road. It appears to be expanding its range in the Sierra Nevada. *F. arundinacea* is an important forage species and has been sown extensively in irrigated pastures in California (Raguse et al. 1967) and rangeland and irrigated pastures in Idaho, Nevada, Oregon and Washington (Buckner and Cowan 1973, Sleper and West 1996). Many populations of this species host a fungal endophyte which produces an alkaloid that causes severe health disorders in domestic grazing animals (Sleper and West 1996) but nothing is known about the effect of the toxin on wild herbivores. *F. arundinacea* is tolerant of wet soils and forms a dense turf (Buckner and Cowan 1973). Its seed persist in the soil for a short time, usually only one year (Lewis 1973). There is no information about control methods in the literature but there is a wealth of biological information in the agronomy and range literature (Buckner and Cowan 1973, Buckner and Bush 1979, Sleper and West 1996). Because this species is a common invader of riparian habitats herbicide options may be very limited.

***Phalaris arundinacea*** (reed canary grass) is ranked as one of the most invasive exotic species by the PNEPPC. Its CalFlora distribution is along the northern coast, the extreme northern portion of the state, the American River drainage and the San Joaquin Valley (Appendix G). This disjunct distribution suggests that *P. arundinacea* may be in the process of greatly expanding its range in California. *P. arundinacea* is found only in Sequoia-Kings Canyon NP at the Ash Mountain park boundary, Azalea Campground, Columbine Campground, along the Generals Highway, Grant Grove Developed Area (especially in the streams around Wilsonia) and Lodgepole Developed Area. Directed surveys along riparian areas in Yosemite NP may discover populations in that park as well. There is some speculation that some native populations of *P. arundinacea* existed in the inland areas of the Pacific Northwest region but this is now an academic issue due to extensive hybridization with introduced genotypes (Merigliano and Lesica 1998). In any case, it is clearly an exotic species in the southern Sierra Nevada. *P. arundinacea* is an 0.8 to 2 meter tall perennial grass that spreads through seed and rhizomes and quickly form a dense sod that eliminates all other species. There is no published data on the longevity of its seed in soil. The typical habitats it invades are ditch banks, riparian areas and wet meadows which it dominates through vegetative reproduction and seedling recruitment. This species is dispersed in cow dung and bird droppings (Gillham 1970, Mt. Pleasant and Schlather 1994) and probably also dispersed in the dung of other animals and by water. Control methods vary with habitat and co-occurring native species, and herbicide options are limited in riparian areas.

***Polypogon australis*** (Chilean beard grass) is a 0.1 to 1 meter tall perennial grass that has not been considered for ranking as an invasive species by CalEPPC. It is native to South America and the CalFlora collection data indicates that it invades riparian areas and lakeshores. Its CalFlora distribution indicates that it can greatly increase its range and that it was collected in the Big Oak Flat area in Tuolumne County in 1935 (Appendix G). The only population detected by the directed surveys is located in Sequoia-Kings Canyon NP at the Cedar Grove Pack Station. There is no other information about this species.

***Polypogon interruptus*** (ditch beard grass) is a 0.5 to 0.9 meter tall perennial grass that has not been considered for ranking as an invasive species by CalEPPC. It is native to South America, and the CalFlora collection data indicates that it invades riparian areas. Its CalFlora distribution indicates that it is widespread (Appendix G) but the only population detected by the directed surveys was in Sequoia-Kings Canyon NP on the banks of Yucca Creek 100 meters upstream of the Old Hidden Springs Road.

## Category 2 Species

Less detailed information is presented for Category 2 species due to a paucity of available information; because of their lesser impacts and, given the large numbers of Category 1 species, because of the reduced likelihood that management efforts would be directed at them anytime soon. These are species to monitor for changes in their distributions and ecological impacts. Their status should be reevaluated

periodically as part of an adaptive management plan using data from the parks and from data generated elsewhere.

Sequoia-Kings Canyon NP only: *Echinochloa crus-galli* (barnyard grass), *Festuca pratensis* (meadow fescue), *Phalaris minor*, *Phalaris paradoxa*, *Piptatherum miliaceum* (smilo grass), *Polypogon monspeliensis* (annual beard grass), *Sorghum halepense* (johnsongrass), and *Vulpia bromoides* (brome fescue).

Yosemite NP only: None.

Both Yosemite NP and Sequoia-Kings Canyon NP: *Holcus lanatus* (common velvet grass), *Lolium perenne*, *Phleum pratense*, *Poa bulbosa*, and *Poa compressa* (Canadian bluegrass).

### Category 3 Species

***Bromus tectorum*** (cheat grass) is a 0.05 to 0.4 meter tall annual grass that is ranked as one of the most invasive exotic species by the CalEPPC and which has caused extensive ecological harm in the Intermountain Basin and Range region of the western United States by reducing fire return intervals and creating a deep thatch (Upadhyaya et al. 1986, Billings 1990). Its CalFlora distribution indicates that *B. tectorum* is widely distributed across the state (Appendix G). It is widely distributed in both parks at altitudes between 2000 and 8000 feet. While many of the populations are restricted to roadsides, trailsides, and disturbed areas, many other populations exist in undisturbed open areas on well-drained soils. Quadrat data from an undisturbed *Pinus ponderosa*/*Calocedrus decurrens* forest in Sequoia-Kings Canyon NP indicated that *B. tectorum* occurred in only 3% of the quadrats and its maximum cover was only 1%. This low level of cover in intact forest is similar to that reported for a *Pinus ponderosa* forest in eastern Washington where *B. tectorum* only attained high cover in canopy gaps, and the individuals outside of the gaps produced only 1 seed on average (Pierson and Mack 1990b, a). The authors of that study concluded that *B. tectorum* could not successfully invade those forests without a substantial increase in the size and frequency of canopy disturbance. The distribution of *B. tectorum* in the parks and the published studies suggest that *B. tectorum* is likely to have the greatest impact on native species that require persistent canopy gaps, on native ephemeral species that persist in the soil seed bank until a major disturbance occurs and on the seedlings of perennial and woody species. *B. tectorum* seed is adhesive and is dispersed on footwear and on fur. It is also dispersed in dung, in hay and on vehicles (Lehrer Jr. and Tisdale 1956, Schmida and Ellner 1983, Mosley et al. 1999). Its seed viability in soil is less than 5 years (Upadhyaya et al. 1986).

***Poa pratensis*** (Kentucky bluegrass) is a 0.2 to 0.7 meter tall perennial grass that is ranked as one of the most invasive exotic species by the PNEPPC and is considered to be invasive in wet to moist meadows in the Sierra Nevada (Menke et al. 1996). There is speculation that *P. pratensis* ssp. *agassizensis* may be a native species in the Rocky Mountains (Wedin and Huff 1996) and possibly in the Sierra Nevada, but the directed surveys at both parks detected only the exotic *P. pratensis* ssp. *pratensis* which is also the only subspecies present in the park floras. Its CalFlora distribution indicates that it has a wide distribution in California (Appendix G). The directed-survey data indicate that this species is widely distributed in both parks and is displacing native species at some locations. A study in the Rocky Mountains found that *Poa palustris* (fowl bluegrass) is a more aggressive exotic invader of ungrazed riparian areas and wet meadows and speculated that it may be frequently misidentified as *P. pratensis* (Schultz and Leininger 1990). Misidentification of the two species is also common in California (Menke et al. 1996). The CalFlora distribution indicates that *P. palustris* is widely distributed in the Sierra Nevada (Appendix G). *P. pratensis* seed is dispersed by adhering to animals and humans, in cow dung (Dore and Rammond 1942, Welch 1985, Mt. Pleasant and Schlather 1994, Fischer et al. 1996), and probably in horse dung also. Its seed is viable in soil for at least 4 years (Lewis 1973), and it forms a persistent seed bank (Tsuyuzaki and Kanda 1996). When grassland containing *P. pratensis* is grazed, the species responds with a 10 fold increase in seed production (Willms and Quinton 1995). *P. pratensis* spreads vegetatively by rhizomes to form a dense sod. It is more tolerant of continuous, close grazing than any other cool-season grass and is especially tolerant of close grazing by horses and sheep (Wedin and Huff 1996). In the mountains of Oregon it frequently invades lightly grazed meadows of native grasses and clear-cuts sown with various

cool season perennial grass mixtures (Krueger and Winward 1974, Miller and Krueger 1976, Miller et al. 1981, Holecheck et al. 1982, Kauffman et al. 1983).

## Part IV. Additional Recommendations

The field data and literature that were analyzed in producing this report suggest that both additional data and new park procedures are required for the effective management of exotic species. These additional requirements can be grouped into three general categories.

### SURVEY

- 1) Survey all low and mid elevation riparian areas in both parks and survey high elevation riparian areas near private inholdings or areas where domesticated grazing animals are either permitted or trespass.
- 2) Survey all meadows to determine the extent of the *Poa pratensis* invasion and the presence of *Poa palustris*.
- 3) Survey additional disturbed areas, including road and trail corridors, in all three parks to further document present distributions
- 4) Survey the Siberian Outpost and other dry meadows as well as the Big Whitney Meadow in Inyo National Forest periodically to ensure that exotic species adapted to the Basin and Range region are not invading Sequoia NP.
- 5) Survey the areas within 100 m of private inholdings, farther if exotic species extend farther.
- 6) Survey roadsides and trails of National Forests and other areas with roads or trails that abut the parks.
- 7) Maintain all of the survey data in a Geographic Information System.

### RESEARCH

- 1) Conduct research on the Category 3 species to determine their extent, growth rates, dispersal vectors, and impacts on native species.
- 2) Model the invasion potential of Category 1 species

### PROCEDURAL

- 1) Establish rapid response procedures for exotic species management.
- 2) Establish procedures for managing areas of natural disturbances to ensure that they are not invaded by exotic species.
- 3) Establish protocols for recording, mapping and monitoring disturbances caused by construction equipment, earth moving equipment, field crews, etc.
- 4) Require that all pack animals used in the parks be fed certified weed-free feed.
- 5) Eliminate the grazing by domestic animals of areas invaded by nonnative Kentucky bluegrass (*Poa pratensis ssp. pratensis*) to avoid contributing to its spread
- 6) Require the use of native grasses in lawns and prohibit the introduction of herbicide-resistant cultivars and invasive cultivars.

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Table 1. Interpretation of Sequoia-Kings Canyon NP site cluster analysis.

Cluster Characteristics				Code	Site	Cluster		
Low Elevation & High Richness	Xeric	High Forb Richness		CPO2117 DHO2697	Potwisha Campground Hospital Rock Picnic Area	1		
		Moderate Forb Richness		CBU2822 DMF2112 DPB1398 DNF1773 UCO2307	Buckeye Campground Middle Fork Flume Ash Mountain Park Boundary North Fork Parking Lot Colony Mill Dirt Road	2		
		Low and Upper Elevation Spp.		PCE4701	Cedar Grove Pack Station	3		
	Mesic	Irrigated – High Richness		DAS1605	Ash Mountain Headquarters	4		
		Riparian		RMF1545 RNF1726 RYU1829 RSY1880	Middle Fork of Kaweah River North Fork of Kaweah River Yucca Creek Sycamore Creek	5		
Mid to High Elevation Species	Grass Dominated & Low Forb Richness	Predominantly Annual Grasses	Low Elevation Spp. Moderate Richness		CSF3728 DCS4897 TOL2189	South Fork Campground Crystal Cave Parking Lot Old Hidden Springs Trail	6	
			Mid Elevation spp. /Low Richness	<i>Bromus tectorum</i> & <i>Vulpia myuros</i>	CSH4564 GBE7620 TBE7164 TKA7621 THI7779 TLE5702 CMO4764 TRA7314 DBI6323 DSE6350 PGR6417 DOR5356 DMI6211	Sheep Creek Campground Bearpaw Meadow Giant Forest to Bearpaw Meadow Trail Bearpaw Meadow to Kaweah Gap Trail High Sierra Trail Lewis Creek Trail Moraine Campground Rae Lakes Trail (7000 ft) Big Stump Picnic Area Giant Forest Sewage Treatment Facility Grant Grove Pack Station Oriole Lake Air Strip Milk Ranch Lookout	7	
					Riparian	RTR4573	Trauger's Creek	8
					<i>T. officinale</i> or Low Frequency Forbs	Low Frequency Forbs	CSW6223 TSE6072 CAT6415 GKE6400 GHO8511 TGI6344 DGF6440	Swale Campground Sequoia Lake Trail Atwell Mill Campground Kern Canyon Ranger Station Pasture Hockett Meadow Giant Forest Trail Giant Forest Developed Area
		Forb Primarily <i>Taraxicum officinale</i>	GGR7720 GWI8003 GAU8015 TKE8800 TRA9373 TMA7151 TTA7891 TTU8560 TKE6600 TKA7800 THO7347	Grasshopper Meadow Williams Meadow Austin Meadow Kern Canyon Trail (8000 ft) Rae Lakes Trail (9000 ft) Marvin Pass Trail Tar Gap Trail Tuohy Meadow Trail Kern Canyon Trail (6000 ft) Bearpaw Meadow to Kaweah Gap Trail Atwell Mill Cg. to Hockett Meadow Trail			10	
			Presence of <i>Rumex acetosella</i> & <i>Spergularia rubra</i>			CCR6631 TRA6513 DWO7200 GSU7340 GJR7380 GSC7456 GJU8115 THA5506 TCM6700 TRE6060	Crystal Springs Campground Rae Lakes Trail (6000 ft) Wolverton Snow Park Sugarloaf Meadow J. R. Meadow Scaffold Meadow Junction Meadow Hart Loop Trail Crescent Meadow Redwood Canyon Trail	11
		Forbs	Miscellaneous Forbs		CAZ6454 DCO6533 DGR6593 DRE7121 UCA6754 TRA5143	Azalea Campground Columbine Picnic Area Grant Grove Developed Area Red Fir Maintenance Yard Kings River Rae Lakes Trail (5000 ft)	12	

Table 1 (continued). Interpretation of Sequoia-Kings Canyon NP site cluster analysis.

Cluster Characteristics			Code	Site	Cluster
Mid to High Elevation Spp.	Forbs	Miscellaneous Forbs	UCA6754	Camp Conifer Dirt Road	12
			DCE4671	Cedar Grove Market and Lodge	
			ICE4890	Cedar Grove Paved Road	
			CDO6721	Dorst Campground	
			CCO7477	Cold Springs Campground	
			ISH2118	Shepard Saddle Paved Road	
			PWO7037	Wolverton Pack Station	
			PMI7878	Mineral King Pack Station	
		<i>Bromus tectorum</i> , <i>Poa pratensis</i> <i>Verbascum thapsus</i> & Miscellaneous Forbs	UOR5340	Oriole Lake Dirt Road	13
			GOR5353	Oriole Lake Meadow	
	No Exotic Species		UMI5718	Mineral King Dirt Road	None
TBL5763			Old Black Oak Trail		
TEV8511			Evelyn Lakes Trail		
TMI8100			Mitchell Pass Trail		
TNE8840			New Army Pass Trail		
TSI10800			Siberian Outpost Trails		
TSU8511			Sunset Lakes Trail		

Code:

First letter,

C = Campground

D = Development

G = Pasture/Meadow

I = Paved Road

P = Pack Station

R = Riparian

T = Trail

U = Dirt Road;

Second and third letters,

Unique site ID;

Numerals,

#### = Elevation (ft).

Table 2. Exotic plant species richness by survey type and by site, Yosemite National Park.

Road Species Richness Summary – by Road Section			Road Species Richness Summary - by Richness levels		
Road	Elevation (ft)	Exotic Species Richness	Road	Elevation (ft)	Exotic Species Richness
Big Oak Flat Road	4661	17	Northside Drive	3959	31
Big Oak Flat Road	4946	18	Southside Drive	3958	26
Big Oak Flat Road	5272	16	Yosemite West	5969	22
Big Oak Flat Road	5902	8	Wawona Road	3964	20
Glacier Point Road	6179	1	El Portal Road	3842	18
Glacier Point Road	6440	4	Big Oak Flat Road	4946	18
Glacier Point Road	7176	1	Big Oak Flat Road	4661	17
Glacier Point Road	7704	1	Big Oak Flat Road	5272	16
Hetch Hetchy Road	5505	9	Wawona Road	6051	16
El Portal Road	3842	18	Wawona Road	5142	15
Northside Drive	3959	31	Wawona Road	6040	14
Southside Drive	3958	26	Hetch Hetchy Road	5505	9
Tioga Road	6254	7	Big Oak Flat Road	5902	8
Tioga Road	7143	2	Tioga Road	6254	7
Tioga Road	7981	2	Glacier Point Road	6440	4
Tioga Road	8127	2	Tioga Road	8472	4
Tioga Road	8150	2	Tioga Road	7143	2
Tioga Road	8472	4	Tioga Road	7981	2
Tioga Road	8674	1	Tioga Road	8127	2
Wawona Road	3964	20	Tioga Road	8150	2
Wawona Road	5142	15	Glacier Point Road	6179	1
Wawona Road	6040	14	Glacier Point Road	7176	1
Wawona Road	6051	16	Glacier Point Road	7704	1
Yosemite West	5969	22	Tioga Road	8674	1
<b>Roadside Species</b>		<b>Total = 58</b>	<b>Roadside Species</b>		<b>Total = 58</b>
Trail Species Richness Summary – by Trail			Trail Species Richness Summary – by Richness Levels		
Trail	Elevation (ft)	Exotic Species Richness	Trail	Elevation (ft)	Exotic Species Richness
Alder Creek	4557	7	Meadow Loop	4053	32
Bridalveil Creek	6969	2	Yosemite Loop	3972	26
Bridalveil Falls	4035	7	Mirror Lake Pack	3931	14
Bridalveil-Inspiration Pt.	4036	6	Two Hour	5256	13
Chilnaulna Falls	4417	6	Happy Isles	4959	12
Four Mile	3960	11	Four Mile	3960	11
Glen Aulin	8686	3	Old Big Oak Flat Rd.	4770	9
Happy Isles	4959	12	Snow Creek	4100	9
Harden Lake	7821	4	Yosemite Falls	4015	8
Inspiration Pt.	4381	5	Alder Creek	4557	7
John Muir-Tuolumne	8675	2	Bridalveil Falls	4035	7
Lukens Lake	7886	2	Bridalveil-Inspiration Pt.	4036	6
Meadow Loop	4053	32	Chilnaulna Falls	4417	6
Merced Grove	4771	2	Inspiration Pt.	4381	5
Mirror Lake Pack	3931	14	Harden Lake	7821	4
Old Big Oak Flat Rd.	4770	9	Panorama	7243	4
Panorama	7243	4	Glen Aulin	8686	3
Porcupine Creek	8100	1	Tamarack Creek	6339	3
Snow Creek	4100	9	Bridalveil Creek	6969	2
Taft Point	7729	1	John Muir-Tuolumne	8675	2
Tamarack Creek	6339	3	Lukens Lake	7886	2
Two Hour	5256	13	Merced Grove	4771	2
Yosemite Falls	4015	8	Young Lakes	8622	2
Yosemite Loop	3972	26	Porcupine Creek	8100	1
Young Lakes	8622	2	Taft Point	7729	1
<b>Trailside Species</b>		<b>Total = 52</b>	<b>Trailside Species</b>		<b>Total = 52</b>

Corral Species Richness Summary - by Site			Corral Species Richness Summary – by Richness level		
Corral/Stable Site	Elevation	Exotic Species Richness	Corral/Stable Site	Elevation	Exotic Species Richness
Concession Stables(YV)	4000	33	Glen Aulin High Sierra Camp	7832	2
Glen Aulin High Sierra Camp	7832	2	Government Corrals (Tuol)	8695	2
Government Stables (YV)	4039	13	Harden Lake Corral	7496	8
Government Corrals (Tuol)	8695	2	Tuolumne Stables	8632	8
Harden Lake Corral	7496	8	White Wolf Corral	7967	10
Hetch Hetchy Corral	3960	31	Government Stables (YV)	4039	13
McCauley Ranch	4093	33	Wawona Stables	4001	20
Tuolumne Stables	8632	8	Hetch Hetchy Corral	3960	31
Wawona Stables	4001	20	Concession Stables(YV)	4000	33
White Wolf Corral	7967	10	McCauley Ranch	4093	33
<b>Species of Corrals/Stables</b>		<b>Total = 62</b>	<b>Species of Corrals/Stables</b>		<b>Total = 62</b>

Table 3. Yosemite NP 1998 trail survey data.

Trail	Elevation	Richness	Abund.	Dist.	Human	Pack	Most Abundant Species
Four Mile	3960	11	1-4	1-2	High	Low	<i>B. tectorum</i> , <i>Rumex acetosella</i>
Bridalveil Falls	4035	7	2-4	1-3	High	0	<i>B. tectorum</i> , <i>Poa pratensis</i>
Bridalveil Falls/Inspiration Pt.	4036	6	1-3	1-2	Low	Low	<i>B. tectorum</i> , <i>Vulpia myuros</i>
Inspiration Point	4381	5	2-5	1-4	Mod.	Low	<i>B. tectorum</i> , <i>Silene latifolia</i>
Two Hour	5256	13	1-5	1-3	Low	High	<i>B. tectorum</i> , <i>P. pratensis</i> ,
Panorama	7243	4	2-4	2	Mod.	Low	<i>B. tectorum</i> , <i>Spergularia rubra</i>

Notes: 1) Elevation is trail head elevation in feet; 2) Richness is exotic species richness; 3) Abund. is range of abundance with categories, 1 is 0-10, 2 is 11-100, 3 is 101-1000, 4 is 1001-10000, 5 is >10000 ; 4) Dist. is the range of distributions of exotic species where 1 is scattered individuals, 2 is scattered clumps of individuals, 3 is large clumps of many individuals, and 4 is widespread throughout the area; 5) Human indicates human use level, Low (0- 50 people per year), Moderate (51-1100 people per year), and High (1101-6900 people per year) ; 6) Pack indicates pack animal use level, Low (3-10 animals per day), Moderate (11-25 animals per day, and High (>26 animals per day), and; 7) Lists the two most common exotic species with abundances greater that category 2.

Table 4. Yosemite NP 1999 trail transect and survey data.

Trail	Elevation	Richness	Exotic	Native	Human	Pack	Common Species
Mirror Lake Pack	3931	13/15	0-5/H**	0-5/H	High	High	<i>Bromus tectorum</i> , <i>Trifolium repens</i>
Yosemite Loop	3972	21/25	0-5/L	0-6/L	High	High	Many species
Happy Isles	4000	8/13	0-4/H**	0-5/H	High	High	<i>Marubium vulgare</i>
Yosemite Falls	4015	1/9	0-1/H	0-4/H	High	Low	None
Meadow Loop, Wawona	4053	14/31	0-4/L	0-4/L	Mod.	Mod.	<i>Rumex acetosella</i> , <i>Vulpia myuros</i>
Snow Creek	4100	2/8	0-1/H	0-3/H	Low	Low	None
Chilnaulna Falls	4417	2/6	0-1/H	0-5/L	Low	Mod.	None
Alder Creek	4557	4/7	0-5/H	0-4/H	Low	High	<i>V. myuros</i> , <i>B. tectorum</i>
Merced Grove	4770	0/2	0	0-6/H	Low	Low	None
Old Big Oak Flat	4770	5/9	0-4/H	1-6/0	Mod.	0	<i>B. tectorum</i> , <i>V. myuros</i>
Tamarack Creek	6339	1/3	1/H	0-4/H	Low	0	None
Bridalveil Creek	6969	1/2	0	0-6/0	Low	Mod.	None
Taft Point	7729	0/1	0	0-5/L	Mod.	0	None
Harden Lake	7821	1/4	1-2/H	0-5/L	Low	Low	None
Lukens Lake	7886	2/2	0-1/H**	0-5/0	Low	High	None
Porcupine Creek	8100	0/1	0	0-4/H	Mod.	Low	None
Sunrise High Sierra Camp	8174	0/0	0	0-6/L	High	Mod.	None
Cathedral Lake	8552	0/0	0	0-5/L	High	High	None
Young Lake	8622	2/2	1/H	0-6/0	Mod.	High	None
John Muir Trail, Tuolumne	8675	2/2	1-2/H	1-6/L	Mod.	High	None
Glen Aulin	8686	1/3	1/H	0-6/0	High	High	None
May Lake	8881	0/0	0	0-6/L	High	Mod.	None

Notes: 1) Elevation is trail head elevation in feet; 2) Richness is exotic species richness for Transect/Survey sampling methods respectively; 3) Exotic is range of cover in individual quadrats and patchyness among quadrats respectively. Cover categories for the lowest and highest value for any individual species are: 0 = no cover, 1 is < 5%, 2 is 5-10 %, 3 is 11-30 %, 4 is 31-70 %, 5 is 71-90 %, and 6 is 91-100 %. Patchness categories for the lowest and highest value for any individual species were determined as: 0 indicates less than 10 quadrats had 0 or < 5 % cover for any species, L indicates that between 10 and 24 quadrats had 0 or < 5 % cover for any species, and H indicates that 25 or more quadrats had 0 or < 5 % cover for any species. \*\* indicates that exotic species were found only in the first 2 transects (100 m); 4) Native values represent cover in individual quadrats/patchyness of all native species combined and the categories are the same as Exotic; 5) Human indicates human use level, Low (0- 50 people per year), Moderate (51-1100 people per year), and High (1101-6900 people per year) ; 6) Pack indicates pack animal use level, Low (3-10 animals per day), Moderate (11-25 animals per day, and High (>26 animals per day), and; 7) Common Species lists the 2 most common species with cover greater that category 2.



Table 5. Interpretation of Yosemite NP site cluster analysis.

Cluster Characteristics				Code	Site	Cluster
High Richness of Low, Mid, and High Elevation Species	Not Upper Rancheria – Old El Portal Area	Unique Combinations of Species	Unique Combinations of Species	CLR3930 DYV4073 SMC4093 TYL3972 CWA3927 RSO3958 CUP3950 RNO3959	Lower River Campground Yosemite Village McCauley Ranch Yosemite Loop Trail Wawona Campground Southside Drive Upper Pines Campground Northside Drive	1
			Wawona – Foresta Area	DMW4086 DFW4278 DWW4087 DEW4140 DFE4287 TMW4053	Middle Wawona Foresta West West Wawona East Wawona Foresta East Meadow Loop Trail, Wawona	2
		Yosemite Valley Perennial Grasses and <i>Rubus discolor</i>	CLP3950 CBA4022 DHO3900 DCU3950 CNP4066 DYL3992 SRI4000	Lower Pines Campground Backpacker's Camp Housekeeping Curry Village North Pines Campground Yosemite Lodge Concession Stables (YV)	3	
	Upper Rancheria – Old El Portal Area			DRE1854 DLE2006 DUE2010	Upper Rancheria – El Portal Lower Old El Portal Upper Old El Portal	4
Moderate to Low Richness	Mixtures of Low, Mid, and High Elevation Species	High Proportion of Forb Species	<i>Bromus tectorum</i> and <i>Vulpia myuros</i> With Mixtures of Low and Mid Elevation Species Typically Trails	CSU3981 TBI4036 TCH4417 CHO4684 TBO4770 TYF4015 DMI4094 TAL4557 RHE5505 TSC4100 THI4000 TBF4035 TFO3960 TTH5256	Sunnyside Campground Bridalveil-Inspiration Pt. Trail Chilnaulna Falls Trail Hogdon Meadow Campground Big Oak Flat Road Trail Yosemite Falls Trail Mirror Lake Alder Creek Trail Hetch Hetchy Road Snow Creek Trail Happy Isles Trail Bridalveil Falls Trail Four Mile Trail Two Hour Trail	5
			High Proportion of Mid Elevation Forb Species	CCR6180 RBO5902 DUM5808 RTI6254 RGL6440 DLM5808 DBS7262 RWA6051	Crane Flat Campground Big Oak Flat Road (5902) Upper Mariposa Grove Tioga Road (6254) Glacier Point Road (6440) Lower Mariposa Grove Badger Pass Ski Resort Wawona Road (6051)	6
		High Species Richness	DAH4007 RWA5143 RWA6040 TML3931 RYW5969	Ahwahnee Wawona Road (5143) Wawona Road (6040) Mirror Lake Pack Trail Yosemite West Road	7	
	High Proportion of Grass Species		CHE4100 RWA3964 SWS4001 RBO4946 RHI3842 RBO5272 RTI4661 SHE3960 SGS4039	Hetch Hetchy Backpacker's Camp Wawona Road (3964) Wawona Stables Big Oak Flat Road (4946) El Portal Road Big Oak Flat Road (5272) Tioga Road (4661) Hetch Hetchy Corral Government Stables	8	

Table 5 (continued). Interpretation of Yosemite NP site cluster analysis.

Cluster Characteristics		Code	Site	Cluster
Moderate to Low Richness (Continued)	Mixtures of Mid, and High Elevation Species	CTA6305 TGL8686 DBP7054 CBR6966 CYC7167 RTI7143 RTI8127 RTI8150 TTC6339 RTI8472 RGL6179 TMG4770 TPC8100 CWH7862 RGL7176 RGL7704 RTI8674 DTG5794 RTI7981 TPA7243 CTU8583 THA7821 TLU7886 TJM8675	Tamarack Flat Campground Glen Aulin Trail Badger Pass Parking Area Bridalveil Campground Yosemite Creek Campground Tioga Road (7143) Tioga Road (8127) Tioga Road (8150) Tamarack Creek Trail Tioga Road (8472) Glacier Point Road (6179) Merced Grove Trail Porcupine Creek Trail White Wolf Campground Glacier Point Road (7176) Glacier Point Road (7704) Tioga Road (8674) Tuolumne Grove Tioga Road (7981) Panorama Trail Tuolumne Meadows Campground Harden Lake Trail Lukens Lake Trail John Muir Trail, Tuolumne	9
	Relatively Higher Porportion of Low, Mid, and High Elevation Grasses	CGL7832 CVH10108 TTP7729 SGS8695 TBC6969 TYO8622 TIN4381 SHA7496 SWH7963 STU8632	Glen Aulin High Sierra Camp Vogelsang High Sierra Camp Taft Point Trail Government Corral, Tuolumne Bridalveil Creek Trail Young Lake Trail Inspiration Point Trail Harden Lake Corral White Wolf Corral Tuolumne Consessions	10
No Exotic Species		CMA9307 CSU9240 RGL7450 TCA8552 TMA8881 TSU8174	May Lake High Sierra Camp Sunrise High Sierra Camp Glacier Point Road (7450) Cathedral Lake Trail May Lake Trail Sunrise High Sierra Trail	None

Code:

First letter,

C = Campground

D = Development

G = Pasture/Meadow

I = Paved Road

P = Pack Station

R = Riparian

T = Trail

U = Dirt Road;

Second and third letters,

Unique site ID;

Numerals,

#### = Elevation (ft).

Table 6. Priority exotic species other than grasses.

Class	Species	#	S	Y	Dispersal Mechanisms	Seed Longevity
Broad Dist.	<i>Cirsium vulgare</i>	3	√	√	adhesive, ant, hay, machinery, soil, stock yard, water	5 years
	<i>Verbascum thapsus</i>	3	√	√	dung, water	> 35 years
Localized Wildland Species Moderate to High Impact	<i>Carduus pycnocephalus</i>	1	√	√	adhesive, ant, hay, soil, vehicles, wind	> 10 years
	<i>Centaurea maculosa</i>	1		√	adhesive, dung, hay, mud, machinery, vehicles, water	> 8 years
	<i>Centaurea solstitialis</i>	1	√	√	adhesive, hay, machinery, soil, stock yard	> 10 years
	<i>Convolvulus arvensis</i>	1	√	√	bird droppings, dung, hay, machinery, soil	> 20 years
	<i>Erigeron strigosus</i>	1		√	adhesive, wind	
	<i>Foeniculum vulgare</i>	1		√	adhesive, ant	
	<i>Geranium robertianum</i>	1		√	adhesive	
	<i>Hypericum perforatum</i>	1		√	adhesive, dung, machinery, vehicles, water	10 years
	<i>Marrubium vulgare</i>	1	√	√	adhesive, dung, stockyard	10 years
	<i>Mentha pulegium</i>	1	√		adhesive, dung, machinery, mud, vehicles	
	<i>Mentha spicata</i>	1	√	√		
	<i>Oxalis pes-caprae</i>	1	√		ants, soil	
	<i>Ranunculus parviflorus</i>	1	√			
	<i>Ranunculus testiculatus</i>	1	√		adhesive	
	<i>Scorzonera hispanica</i>	1		√		
	<i>Silybum marianum</i>	1	√		ant, dung, machinery, soil, stock yard, water, wind	
	<i>Tamarix sp.</i>	1	√		water, wind	
	<i>Tragopogon dubius</i>	1	√	√	water, wind	2 years
	<i>Urtica urens</i>	1	√	√	dung, stock yard	5 years
	<i>Verbascum virgatum</i>	1	√			
Localized Legumes Mod. To High Impact	<i>Lathyrus latifolius</i>	1	√	√		
	<i>Medicago sativa</i>	1	√		feed pellets, hay, dung, stock yard, water	20 years
	<i>Melilotus alba</i>	1	√	√	adhesive, dung, water	> 20 years
	<i>Melilotus indica</i>	1	√	√	stock yard	5 years
	<i>Melilotus officinalis</i>	1	√	√	adhesive	> 20 years
	<i>Trifolium repens</i>	1	√	√	adhesive, dung, mud, vehicles	30 years
	<i>Vicia benghalensis</i>	1	√	√		
	<i>Vicia sativa</i>	1	√			
	<i>Vicia villosa</i>	1	√		bird droppings, dung, mud	
Localized Fruit and Nut Species High Impact	<i>Carya sp.</i>	2	√		animals, water	
	<i>Diospyros sp.</i>	2	√		animals, water	
	<i>Ficus carica</i>	1	√		bird droppings, water	
	<i>Juglans californica</i>	1	√		animals, water	
	<i>Juglans regia</i>	1	√		animals, water	
	<i>Malus sylvestris</i>	1	√	?	animals, water	
	<i>Morus alba</i>	1	√		bird droppings, water	
	<i>Olea europaea</i>	2	√		bird droppings, water	
	<i>Prunus persica</i>	2	√		animals	
	<i>Punica granatum</i>	2	√		animals	
	<i>Rubus discolor</i>	1	√	√	bird droppings, water	
	<i>Rubus laciniatus</i>	1		√	bird droppings, water	
	<i>Vitis vinifera</i>	1	√	√	bird droppings, water	

Table 6 (continued). Priority exotic species other than grasses.

Class	Species	#	S	Y	Dispersal Mechanisms	Seed Longevity
Localized Ornementals High Impact	<i>Ampelopsis arborea</i>	1	√		bird droppings, water	
	<i>Catalpa bignonioides</i>	1	√		wind, water	
	<i>Cistus sp.</i>	1	√			
	<i>Coreopsis lanceolata</i>	1		√	adhesive, wind	
	<i>Digitalis purpurea</i>	1	√	√	mud, vehicles, wind	> 5 years
	<i>Eucalyptus citriodora</i>	1	√		wind	
	<i>Genista monspessulana</i>	1	√		ant, bird droppings, explosive, mud, machinery, water	> 5 years
	<i>Hedera helix</i>	1	√	√	bird droppings	
	<i>Heteromeles arbutifolia</i>	1	√		bird droppings	
	<i>Iris sp.</i>	2	√			
	<i>Leucanthemum maximum</i>	1		√		
	<i>Leucanthemum vulgare</i>	1		√	adhesive, dung, hay, wildflower seed mix	39 years
	<i>Leucosium aestivum</i>	2	√			
	<i>Ligustrum sinense</i>	1	√		bird droppings, water	
	<i>Nerium oleander</i>	1	√		water, wind	
	<i>Pyracantha angustifolia</i>	1	√		bird droppings, water	
	<i>Rudbeckia hirta</i>	1		√		
	<i>Spartium junceum</i>	1	√		ants, water	> 5 years
	<i>Tanacetum parthenium</i>	1	√	√	mud, vehicles	
	<i>Vinca major</i>	1	√	√		

Notes: Class = tactical class; # = Priority Category; S = Sequoia-Kings Canyon NP, Y = Yosemite NP (? indicates present in flora but not found in directed surveys); seed longevity = viability under natural soil conditions.

Table 7. Priority exotic grass species.

Class	Species	#	S	Y	Dispersal Mechanisms	Seed Longevity
Broad Dist.	<i>Bromus tectorum</i>	3	√	√	adhesive, footwear, dung, hay, vehicles	5 years
	<i>Poa pratensis</i>	3	√	√	adhesive, dung	4 years
Localized Wildland Species Moderate to High Impact	<i>Agrostis capillaris</i>	1	?	?		
	<i>Agrostis gigantea</i>	1	?	√	dung, water	
	<i>Agrostis viridis</i>	1		√		
	<i>Arundo donax</i>	1	√		water	
	<i>Bromus inermis</i>	1		√		
	<i>Dactylis glomerata</i>	1	√	√	adhesive, dung, water	5 years
	<i>Echinochloa crus-galli</i>	2	√		dung, rice straw, stock yard, water	12 years
	<i>Festuca arundinacea</i>	1	√			2 years
	<i>Festuca pratensis</i>	2	√			
	<i>Holcus lanatus</i>	2	√	√	adhesive, bird droppings, dung, mud, soil, stock yard	> 10 years
	<i>Lolium perenne</i>	2	√	√	adhesive, dung, mud, stock yard, vehicles	4 years
	<i>Phalaris arundinacea</i>	1	√		bird droppings, dung	
	<i>Phalaris minor</i>	2	√			
	<i>Phalaris paradoxa</i>	2	√		stock yard	
	<i>Phleum pratense</i>	2	√	√		
	<i>Piptatherum miliaceum</i>	2	√		bird droppings	
	<i>Poa bulbosa</i>	2	√	√		
	<i>Poa compressa</i>	2	√	√	dung	
	<i>Poa palustris</i>	1	?	?		
	<i>Polypogon australis</i>	1	√			
	<i>Polypogon interruptus</i>	1	√			
	<i>Polypogon monspeliensis</i>	2	√		dung, stock yard	
	<i>Sorghum halepense</i>	2	√		bird droppings, dung, hay, machinery, stockyard	> 5 years
	<i>Vulpia bromoides</i>	2	√		adhesive, dung	

Notes: Class = tactical class; # = Priority Category; S = Sequoia-Kings Canyon NP, Y = Yosemite NP (? indicates present in flora but not found in directed surveys); seed longevity = viability under natural soil conditions.

Figure 1. Sequoia-Kings Canyon NP exotic species richness by elevation.

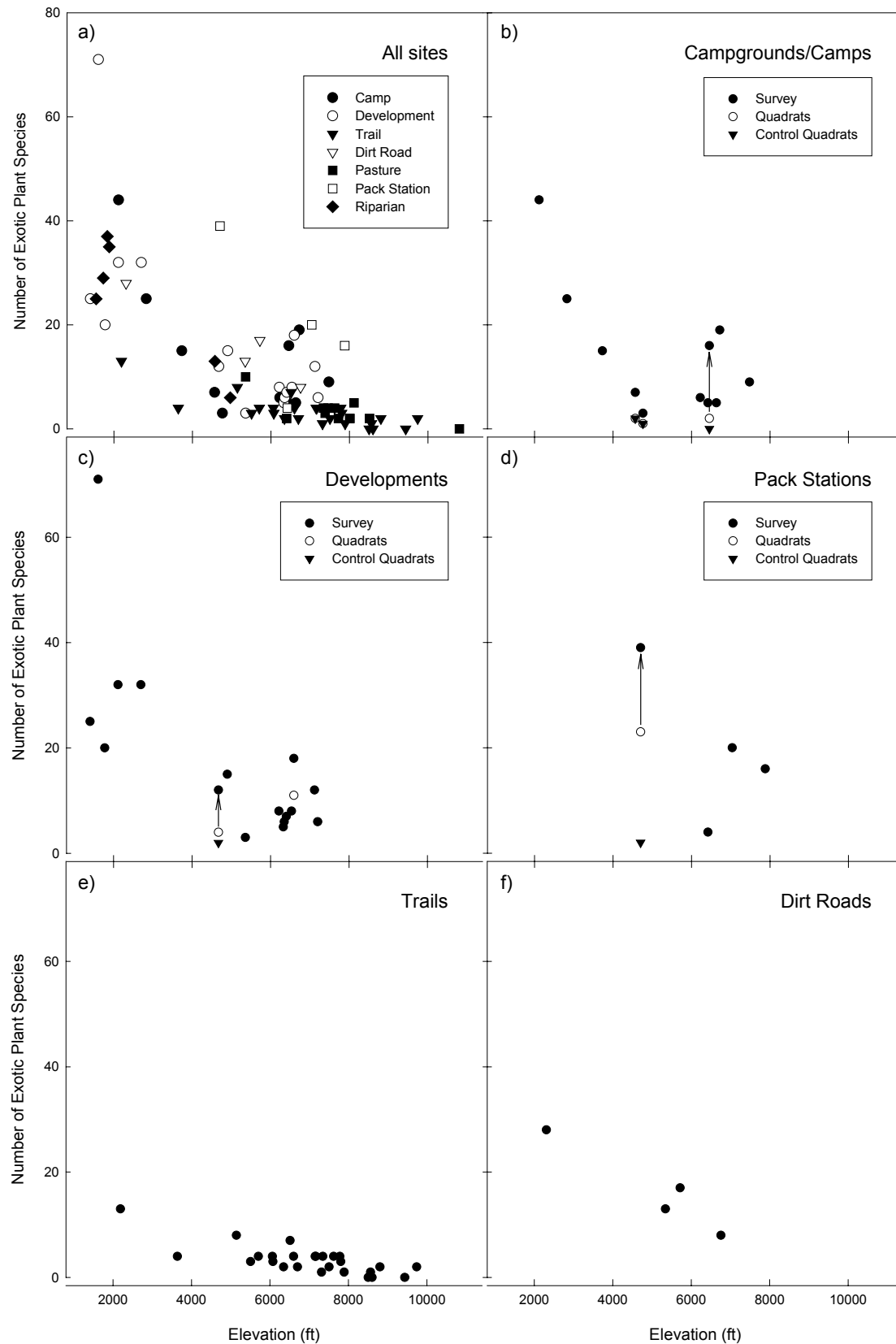


Figure 1 (continued). Sequoia-Kings Canyon NP exotic species richness by elevation.

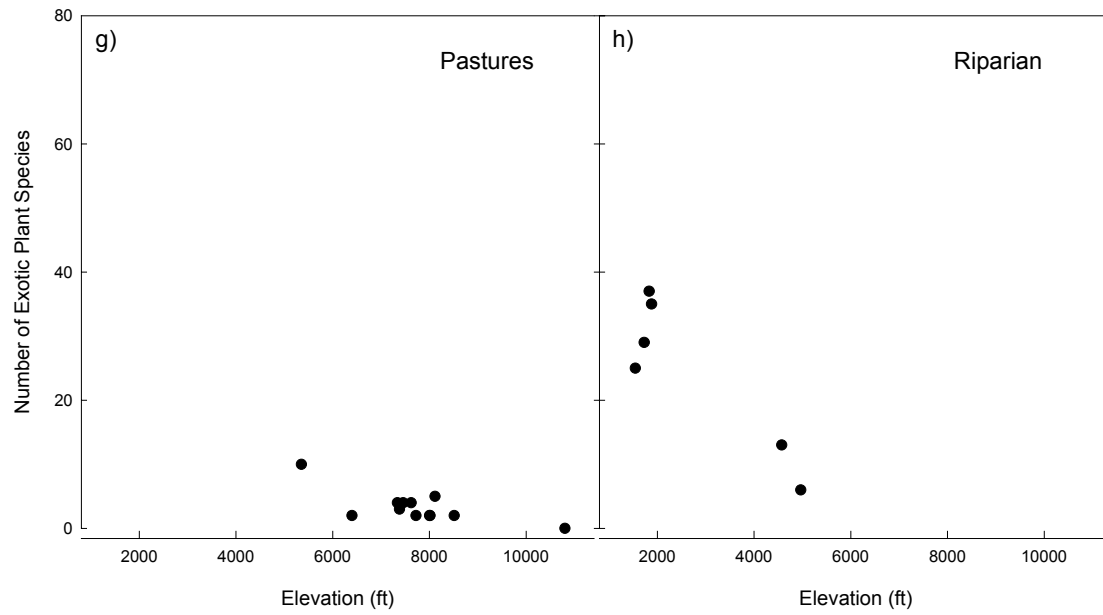




Figure 2. Sequoia-Kings Canyon NP site cluster analysis.

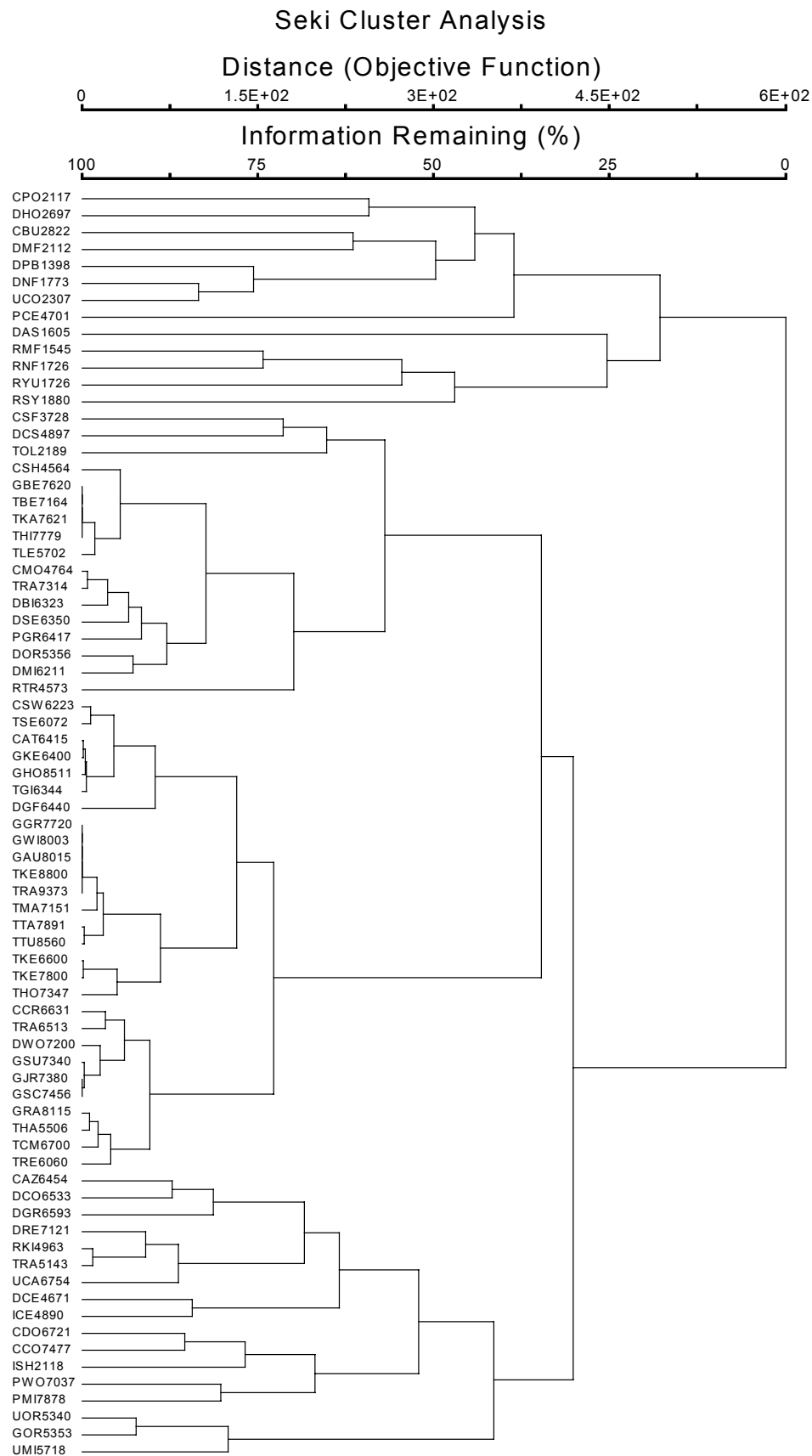


Figure 4. Yosemite NP exotic species richness by elevation.

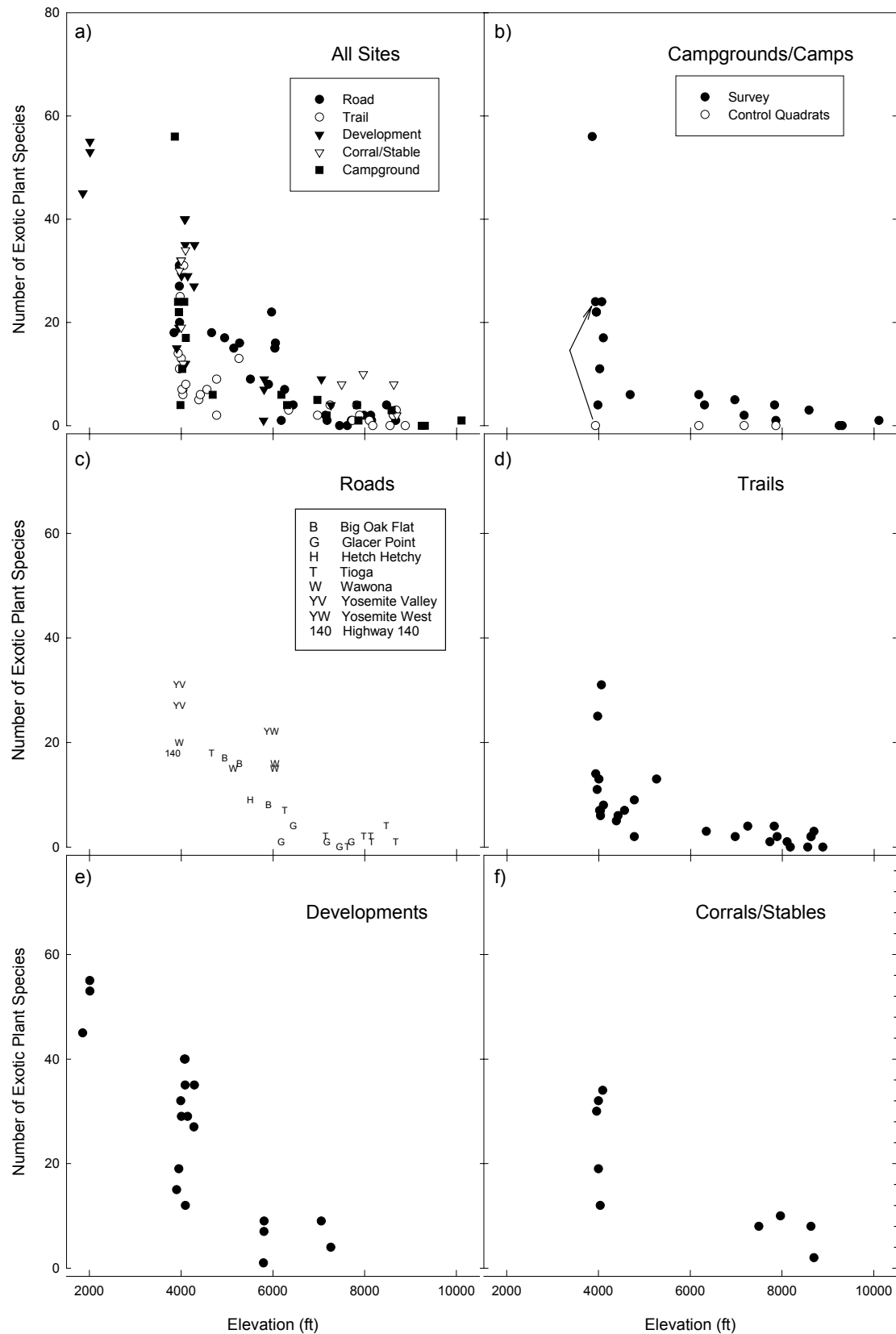
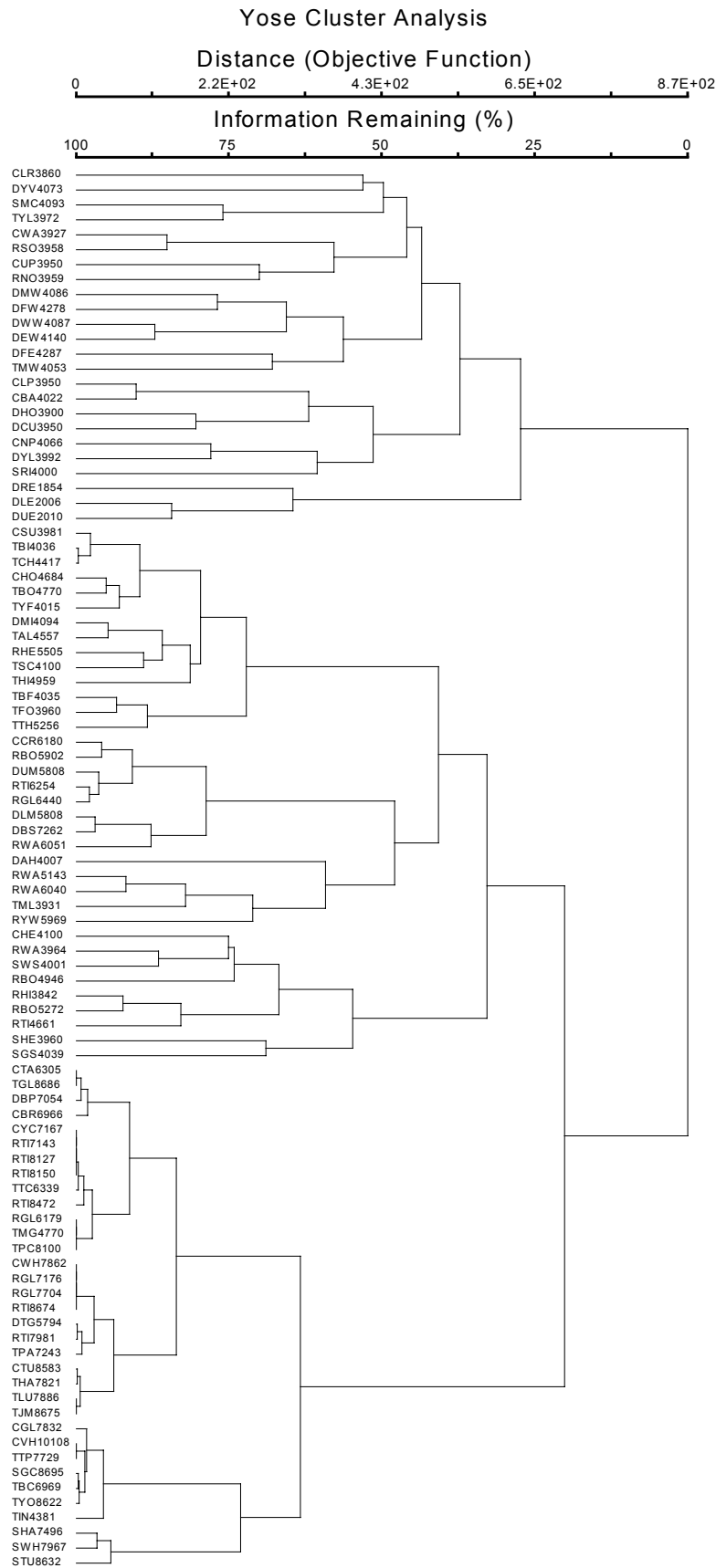


Figure 5. Yosemite NP site cluster analysis.



Appendix A. Sequoia-Kings Canyon National Parks - Priority exotic species by site.

Site	Exotic Species	Site	Exotic Species	Site Type
Ash Mountain Developed Area	Ampelopsis arborea	Ash Mountain Developed Area	Ampelopsis arborea	Development
Ash Mountain Developed Area	Arundo donax	Ash Mountain Developed Area	Arundo donax	Development
Sycamore Creek, M. F. Kaweah	Arundo donax	Ash Mountain Developed Area	Carduus pycnocephalus	Natural
Sunset Campground	Bromus tectorum	Ash Mountain Developed Area	Cistus	Development
Azalea Campground	Bromus tectorum	Ash Mountain Developed Area	Dactylis glomerata	Development
Big Stump Picnic Area	Bromus tectorum	Ash Mountain Developed Area	Festuca arundinacea	Development
Buckeye Campground	Bromus tectorum	Ash Mountain Developed Area	Festuca pratensis	Development
Camp Conifer	Bromus tectorum	Ash Mountain Developed Area	Genista monspessulana	Development
Cedar Grove Market and Lodge	Bromus tectorum	Ash Mountain Developed Area	Hedra helix	Development
Cedar Grove Pack Station	Bromus tectorum	Ash Mountain Developed Area	Heteromeles arbutifolia	Development
Cedar Grove Road	Bromus tectorum	Ash Mountain Developed Area	Lathyrus latifolius	Development
Colony Mill Road	Bromus tectorum	Ash Mountain Developed Area	Leucorum aestivum	Development
Crystal Cave Parking Lot	Bromus tectorum	Ash Mountain Developed Area	Ligustrum sinense	Development
Giant Forest Sewage Plant	Bromus tectorum	Ash Mountain Developed Area	Medicago sativa	Development
High Sierra Trail	Bromus tectorum	Ash Mountain Developed Area	Melilotus indica	Development
Lewis Creek Trail	Bromus tectorum	Ash Mountain Developed Area	Oxalis pes-caprae	Development
Lodgepole Campground	Bromus tectorum	Ash Mountain Developed Area	Poa bulbosa	Development
Middle Fork Flume	Bromus tectorum	Ash Mountain Developed Area	Poa pratensis	Development
Milk Ranch Lookout	Bromus tectorum	Ash Mountain Developed Area	Polypogon monspeliensis	Development
Moraine Campground	Bromus tectorum	Ash Mountain Developed Area	Punica granatum	Development
Oriole Lake Meadow	Bromus tectorum	Ash Mountain Developed Area	Pyracantha angustifolia	Development
Oriole Lake Road	Bromus tectorum	Ash Mountain Developed Area	Spartium junceum	Development
Rae Lakes Loop Trail	Bromus tectorum	Ash Mountain Developed Area	Trifolium repens	Development
Red Fir Maintenance Area	Bromus tectorum	Ash Mountain Developed Area	Verbascum thapsus	Development
Redwood Creek, Mineral King	Bromus tectorum	Ash Mountain Developed Area	Vicia sativa	Development
Sheep Creek Campground	Bromus tectorum	Ash Mountain Developed Area	Vinca major	Development
Sugarbowl Trail	Bromus tectorum	Ash Mountain Park Boundary	Catalpa bignonioides	Development
Wuksachi	Bromus tectorum	Ash Mountain Park Boundary	Eucalyptus citriodora	Development
Zumwalt Meadow Trail	Bromus tectorum	Ash Mountain Park Boundary	Melilotus indica	Development
Ash Mountain Developed Area	Carduus pycnocephalus	Ash Mountain Park Boundary	Phalaris paradoxa	Development
Colony Mill Road	Carduus pycnocephalus	Ash Mountain Slash Pit	Polypogon monspeliensis	Development
Elk Creek Trail, M. F. Kaweah	Carduus pycnocephalus	Ash Mountain Slash Pit	Urtica urens	Development
Hospital Rock	Carduus pycnocephalus	Atwell Mill Campground	Poa pratensis	Campground
North Fork Parking Lot	Carduus pycnocephalus	Atwell Mill Campground	Trifolium repens	Campground
Potwisha Campground	Carduus pycnocephalus	Austin Meadow	Poa pratensis	Pasture
South Fork Campground	Carduus pycnocephalus	Azalea Campground	Bromus tectorum	Campground
Sycamore Creek, M. F. Kaweah	Carduus pycnocephalus	Azalea Campground	Cirsium vulgare	Campground
Yucca Creek, N. F. Kaweah	Carduus pycnocephalus	Azalea Campground	Holcus lanatus	Campground
Grunnigan Ranch	Carya	Azalea Campground	Phalaris arundinacea	Campground
Ash Mountain Park Boundary	Catalpa bignonioides	Azalea Campground	Poa bulbosa	Campground
Generals Highway	Centaurea solstitialis	Azalea Campground	Poa pratensis	Campground
Swale Campground	Centaurea solstitialis	Azalea Campground	Verbascum thapsus	Campground
Sunset Campground	Cirsium vulgare	Azalea Campground	Verbascum virgatum	Campground
Azalea Campground	Cirsium vulgare	Big Stump Picnic Area	Bromus tectorum	Development
Cedar Grove Road	Cirsium vulgare	Big Stump Picnic Area	Poa pratensis	Development
Columbine Picnic Area	Cirsium vulgare	Big Stump Picnic Area	Tragopogon dubius	Development
Crystal Springs Campground	Cirsium vulgare	Buckeye Campground	Bromus tectorum	Campground
Dorst Campground	Cirsium vulgare	Buckeye Campground	Marrubium vulgare	Campground
Ferguson Creek Area	Cirsium vulgare	Buckeye Campground	Poa bulbosa	Campground
Giant Forest Sewage Plant	Cirsium vulgare	Cahoon Meadow	Poa pratensis	Natural
Grant Grove Developed Area	Cirsium vulgare	Camp Conifer	Bromus tectorum	Road
Lodgepole Developed Area	Cirsium vulgare	Camp Conifer	Poa compressa	Road
Marvin Pass Trail	Cirsium vulgare	Camp Conifer	Verbascum thapsus	Road
Milk Ranch Road	Cirsium vulgare	Cedar Grove Market and Lodge	Bromus tectorum	Development
Muir Grove	Cirsium vulgare	Cedar Grove Market and Lodge	Melilotus alba	Development
Old Hidden Springs Road	Cirsium vulgare	Cedar Grove Market and Lodge	Poa bulbosa	Development
Rae Lakes Loop Trail	Cirsium vulgare	Cedar Grove Market and Lodge	Poa pratensis	Development
Red Fir Maintenance Area	Cirsium vulgare	Cedar Grove Pack Station	Bromus tectorum	Corral
Redwood Canyon Trail	Cirsium vulgare	Cedar Grove Pack Station	Phalaris minor	Corral

Site	Exotic Species	Site	Exotic Species	Site Type
Sequoia Lake Trail	Cirsium vulgare	Cedar Grove Pack Station	Poa bulbosa	Corral
South Fork Campground	Cirsium vulgare	Cedar Grove Pack Station	Polypogon australis	Corral
Sugarbowl Trail	Cirsium vulgare	Cedar Grove Pack Station	Polypogon monspeliensis	Corral
Swale Campground	Cirsium vulgare	Cedar Grove Pack Station	Trifolium repens	Corral
Wuksachi	Cirsium vulgare	Cedar Grove Pack Station	Urtica urens	Corral
Zumwalt Meadow Trail	Cirsium vulgare	Cedar Grove Road	Bromus tectorum	Road
Ash Mountain Developed Area	Cistus	Cedar Grove Road	Cirsium vulgare	Road
Potwisha Campground	Convolvulus arvensis	Cedar Grove Road	Festuca arundinacea	Road
Sunset Campground	Dactylis glomerata	Cedar Grove Road	Holcus lanatus	Road
Ash Mountain Developed Area	Dactylis glomerata	Cedar Grove Road	Lolium perenne	Road
Columbine Picnic Area	Dactylis glomerata	Cedar Grove Road	Poa bulbosa	Road
Dorst Campground	Dactylis glomerata	Cedar Grove Road	Poa pratensis	Road
Generals Highway	Dactylis glomerata	Cedar Grove Road	Tragopogon dubius	Road
Giant Forest Developed Area	Dactylis glomerata	Cedar Grove Road	Verbascum thapsus	Road
Lodgepole Developed Area	Dactylis glomerata	Cherry Flat Trail	Poa bulbosa	Trail
Trail For All People	Dactylis glomerata	Cold Springs Campground	Digitalis purpurea	Campground
Cold Springs Campground	Digitalis purpurea	Cold Springs Campground	Poa pratensis	Campground
Giant Forest Developed Area	Digitalis purpurea	Cold Springs Campground	Verbascum thapsus	Campground
Grant Grove Developed Area	Digitalis purpurea	Colony Mill Road	Bromus tectorum	Road
Lodgepole Developed Area	Digitalis purpurea	Colony Mill Road	Carduus pycnocephalus	Road
Sunset Campground	Digitalis purpurea	Colony Mill Road	Morus alba	Riparian
Grunnigan Ranch	Diospyros	Columbine Picnic Area	Cirsium vulgare	Development
Crystal Cave Road.	Echinochloa crus-galli	Columbine Picnic Area	Dactylis glomerata	Riparian
Middle Fork, Kaweah River	Echinochloa crus-galli	Columbine Picnic Area	Phalaris arundinacea	Development
North Fork, Kaweah River	Echinochloa crus-galli	Columbine Picnic Area	Poa pratensis	Development
Rae Lakes Loop Trail	Echinochloa crus-galli	Columbine Picnic Area	Trifolium repens	Development
Sycamore Creek, M. F. Kaweah	Echinochloa crus-galli	Crescent Meadow Trail	Festuca pratensis	Natural
Wuksachi	Echinochloa crus-galli	Crescent Meadow Trail	Phleum pratense	Natural
Ash Mountain Park Boundary	Eucalyptus citriodora	Crescent Meadow Trail	Poa pratensis	Natural
Ash Mountain Developed Area	Festuca arundinacea	Crystal Cave Parking Lot	Bromus tectorum	Development
Cedar Grove Road	Festuca arundinacea	Crystal Cave Parking Lot	Prunus persica	Development
Dorst Campground	Festuca arundinacea	Crystal Cave Parking Lot	Tragopogon dubius	Development
Ash Mountain Developed Area	Festuca pratensis	Crystal Cave Parking Lot	Vulpia bromoides	Development
Crescent Meadow Trail	Festuca pratensis	Crystal Cave Road.	Echinochloa crus-galli	Road
Middle Fork, Kaweah River	Ficus carica	Crystal Springs Campground	Cirsium vulgare	Campground
Yucca Creek, N. F. Kaweah	Ficus carica	Crystal Springs Campground	Poa pratensis	Campground
Ash Mountain Developed Area	Genista monspessulana	Deadman Canyon Trail	Poa pratensis	Riparian
Ash Mountain Developed Area	Hedra helix	Dorst Campground	Cirsium vulgare	Campground
Ash Mountain Developed Area	Heteromeles arbutifolia	Dorst Campground	Dactylis glomerata	Campground
Azalea Campground	Holcus lanatus	Dorst Campground	Festuca arundinacea	Campground
Cedar Grove Road	Holcus lanatus	Dorst Campground	Melilotus alba	Campground
Grant Grove Developed Area	Holcus lanatus	Dorst Campground	Melilotus officinalis	Campground
Marvin Pass Trail	Holcus lanatus	Dorst Campground	Poa pratensis	Campground
Lodgepole Developed Area	Iris	Dorst Campground	Tragopogon dubius	Campground
Yucca Creek, N. F. Kaweah	Juglans californica	Dorst Campground	Trifolium repens	Campground
Yucca Creek, N. F. Kaweah	Juglans regia	Dorst Campground	Verbascum thapsus	Campground
Ash Mountain Developed Area	Lathyrus latifolius	Elk Creek Trail, M. F. Kaweah	Carduus pycnocephalus	Natural
Traugers Creek, E. F. Kaweah	Lathyrus latifolius	Ferguson Creek Area	Cirsium vulgare	Natural
Ash Mountain Developed Area	Leucojum aestivum	Generals Highway	Centaurea solstitialis	Road
Ash Mountain Developed Area	Ligustrum sinense	Generals Highway	Dactylis glomerata	Road
Cedar Grove Road	Lolium perenne	Generals Highway	Melilotus indica	Road
Hospital Rock	Lolium perenne	Generals Highway	Oxalis pes-caprae	Road
Traugers Creek, E. F. Kaweah	Malus sylvestris	Generals Highway	Phalaris paradoxa	Road
Buckeye Campground	Marrubium vulgare	Generals Highway	Sorghum halepense	Road
Potwisha Campground	Marrubium vulgare	Generals Highway	Spartium junceum	Road
Sycamore Creek, M. F. Kaweah	Marrubium vulgare	Generals Highway	Tragopogon dubius	Road
Ash Mountain Developed Area	Medicago sativa	Generals Highway	Vicia sativa	Road
Milk Ranch Road	Medicago sativa	Generals Highway	Vicia villosa	Road
Cedar Grove Market and Lodge	Melilotus alba	Generals Highway	Vinca major	Riparian
Dorst Campground	Melilotus alba	Giant Forest Developed Area	Dactylis glomerata	Development

Site	Exotic Species	Site	Exotic Species	Site Type
Wuksachi	Melilotus alba	Giant Forest Developed Area	Digitalis purpurea	Development
Ash Mountain Developed Area	Melilotus indica	Giant Forest Developed Area	Poa bulbosa	Development
Ash Mountain Park Boundary	Melilotus indica	Giant Forest Developed Area	Poa pratensis	Development
Generals Highway	Melilotus indica	Giant Forest Developed Area	Tragopogon dubius	Development
Sycamore Creek, M. F. Kaweah	Melilotus indica	Giant Forest Developed Area	Verbascum thapsus	Development
Dorst Campground	Melilotus officinalis	Giant Forest Sewage Plant	Bromus tectorum	Development
North Fork, Kaweah River	Mentha pulegium	Giant Forest Sewage Plant	Cirsium vulgare	Development
North Fork, Kaweah River	Mentha spicata	Giant Forest Sewage Plant	Rubus	Development
Colony Mill Road	Morus alba	Grant Grove Developed Area	Cirsium vulgare	Development
Middle Fork, Kaweah River	Morus alba	Grant Grove Developed Area	Digitalis purpurea	Development
Grunnigan Ranch	Nerium oleander	Grant Grove Developed Area	Holcus lanatus	Development
Grunnigan Ranch	Olea europaea	Grant Grove Developed Area	Phalaris arundinacea	Development
Ash Mountain Developed Area	Oxalis pes-caprae	Grant Grove Developed Area	Phleum pratense	Development
Generals Highway	Oxalis pes-caprae	Grant Grove Developed Area	Poa pratensis	Development
Azalea Campground	Phalaris arundinacea	Grant Grove Developed Area	Tanacetum parthenium	Development
Columbine Picnic Area	Phalaris arundinacea	Grant Grove Developed Area	Trifolium repens	Development
Grant Grove Developed Area	Phalaris arundinacea	Grant Grove Developed Area	Verbascum thapsus	Development
Grant Grove Pack Station	Phalaris arundinacea	Grant Grove Pack Station	Phalaris arundinacea	Corral
Lodgepole Developed Area	Phalaris arundinacea	Grant Grove Pack Station	Urtica urens	Corral
Cedar Grove Pack Station	Phalaris minor	Grasshopper Meadow	Poa pratensis	Pasture
Ash Mountain Park Boundary	Phalaris paradoxa	Grunnigan Ranch	Carya	Development
Generals Highway	Phalaris paradoxa	Grunnigan Ranch	Diospyros	Development
Crescent Meadow Trail	Phleum pratense	Grunnigan Ranch	Nerium oleander	Development
Grant Grove Developed Area	Phleum pratense	Grunnigan Ranch	Olea europaea	Development
Hockett Meadow and Pasture	Phleum pratense	Grunnigan Ranch	Punica granatum	Development
Scaffold Meadow	Phleum pratense	Grunnigan Ranch	Pyracantha angustifolia	Development
Trail For All People	Phleum pratense	Grunnigan Ranch	Rubus discolor	Development
North Fork, Kaweah River	Piptatherum miliaceum	Halstead Meadow	Poa pratensis	Natural
Ash Mountain Developed Area	Poa bulbosa	Halstead Meadow	Tragopogon dubius	Natural
Azalea Campground	Poa bulbosa	High Sierra Trail	Bromus tectorum	Trail
Buckeye Campground	Poa bulbosa	High Sierra Trail	Poa pratensis	Trail
Cedar Grove Market and Lodge	Poa bulbosa	Hockett Meadow and Pasture	Phleum pratense	Trail
Cedar Grove Pack Station	Poa bulbosa	Hockett Meadow and Pasture	Poa pratensis	Pasture
Cedar Grove Road	Poa bulbosa	Hospital Rock	Carduus pycnocephalus	Development
Cherry Flat Trail	Poa bulbosa	Hospital Rock	Lolium perenne	Development
Giant Forest Developed Area	Poa bulbosa	Hospital Rock	Poa pratensis	Development
Lodgepole Campground	Poa bulbosa	Hospital Rock	Polypogon monspeliensis	Road
Milk Ranch Lookout	Poa bulbosa	JR Meadow	Poa pratensis	Pasture
Potwisha Campground	Poa bulbosa	Kern Ranger Station Pasture	Poa pratensis	Pasture
Sheep Creek Campground	Poa bulbosa	Lewis Creek Trail	Bromus tectorum	Trail
Camp Conifer	Poa compressa	Lewis Creek Trail	Poa pratensis	Riparian
Sheep Creek Campground	Poa compressa	Lodgepole Campground	Bromus tectorum	Campground
Sunset Campground	Poa pratensis	Lodgepole Campground	Poa bulbosa	Campground
Ash Mountain Developed Area	Poa pratensis	Lodgepole Campground	Poa pratensis	Campground
Atwell Mill Campground	Poa pratensis	Lodgepole Developed Area	Cirsium vulgare	Development
Austin Meadow	Poa pratensis	Lodgepole Developed Area	Dactylis glomerata	Development
Azalea Campground	Poa pratensis	Lodgepole Developed Area	Digitalis purpurea	Development
Big Stump Picnic Area	Poa pratensis	Lodgepole Developed Area	Iris	Development
Cahoon Meadow	Poa pratensis	Lodgepole Developed Area	Phalaris arundinacea	Development
Cedar Grove Market and Lodge	Poa pratensis	Lodgepole Developed Area	Verbascum thapsus	Development
Cedar Grove Road	Poa pratensis	Lodgepole Developed Area	Verbascum virgatum	Development
Cold Springs Campground	Poa pratensis	Marble Fork, Kaweah River	Rubus discolor	Riparian
Columbine Picnic Area	Poa pratensis	Marvin Pass Trail	Cirsium vulgare	Trail
Crescent Meadow Trail	Poa pratensis	Marvin Pass Trail	Holcus lanatus	Trail
Crystal Springs Campground	Poa pratensis	Marvin Pass Trail	Poa pratensis	Trail
Deadman Canyon Trail	Poa pratensis	Middle Fork Flume	Bromus tectorum	Development
Dorst Campground	Poa pratensis	Middle Fork, Kaweah River	Echinochloa crus-galli	Riparian
Giant Forest Developed Area	Poa pratensis	Middle Fork, Kaweah River	Ficus carica	Riparian
Grant Grove Developed Area	Poa pratensis	Middle Fork, Kaweah River	Morus alba	Riparian
Grasshopper Meadow	Poa pratensis	Middle Fork, Kaweah River	Polypogon monspeliensis	Riparian

Site	Exotic Species	Site	Exotic Species	Site Type
Halstead Meadow	Poa pratensis	Middle Fork, Kaweah River	Pyracantha angustifolia	Riparian
High Sierra Trail	Poa pratensis	Middle Fork, Kaweah River	Spartium junceum	Riparian
Hockett Meadow and Pasture	Poa pratensis	Middle Fork, Kaweah River	Tamarix	Riparian
Hospital Rock	Poa pratensis	Milk Ranch Lookout	Bromus tectorum	Development
JR Meadow	Poa pratensis	Milk Ranch Lookout	Poa bulbosa	Development
Kern Ranger Station Pasture	Poa pratensis	Milk Ranch Road	Cirsium vulgare	Road
Lewis Creek Trail	Poa pratensis	Milk Ranch Road	Medicago sativa	Road
Lodgepole Campground	Poa pratensis	Mineral King Pack Station	Poa pratensis	Development
Marvin Pass Trail	Poa pratensis	Mineral King Pack Station	Trifolium repens	Development
Mineral King Pack Station	Poa pratensis	Mineral King Pack Station	Urtica urens	Corral
Oriole Lake Meadow	Poa pratensis	Mineral King Pack Station	Verbascum thapsus	Road
Oriole Lake Road	Poa pratensis	Moraine Campground	Bromus tectorum	Campground
Potwisha Campground	Poa pratensis	Muir Grove	Cirsium vulgare	Natural
Rae Lakes Loop Trail	Poa pratensis	North Fork Parking Lot	Carduus pycnocephalus	Development
Rae Lakes Loop Trail	Poa pratensis	North Fork, Kaweah River	Echinochloa crus-galli	Riparian
Rae Lakes Loop Trail	Poa pratensis	North Fork, Kaweah River	Mentha pulegium	Riparian
Rae Lakes Loop Trail	Poa pratensis	North Fork, Kaweah River	Mentha spicata	Riparian
Rattlesnake Creek Trail	Poa pratensis	North Fork, Kaweah River	Piptatherum miliaceum	Riparian
Red Fir Maintenance Area	Poa pratensis	North Fork, Kaweah River	Polypogon monspeliensis	Riparian
Redwood Creek, Mineral King	Poa pratensis	North Fork, Kaweah River	Rubus discolor	Riparian
Scaffold Meadow	Poa pratensis	North Fork, Kaweah River	Tamarix	Riparian
Sequoia Lake Trail	Poa pratensis	North Fork, Kaweah River	Verbascum thapsus	Riparian
Sheep Creek Campground	Poa pratensis	Old Hidden Springs Road	Cirsium vulgare	Riparian
Sugarloaf Meadow	Poa pratensis	Old Hidden Springs Road	Silybum marianum	Trail
Traugers Creek, E. F. Kaweah	Poa pratensis	Old Hidden Springs Road	Vicia benghalensis	Road
Williams Meadow	Poa pratensis	Oriole Lake Airstrip	Vulpia bromoides	Development
Wolverton Snow Play Area	Poa pratensis	Oriole Lake Meadow	Bromus tectorum	Pasture
Yucca Creek, N. F. Kaweah	Poa pratensis	Oriole Lake Meadow	Poa pratensis	Pasture
Zumwalt Meadow Trail	Poa pratensis	Oriole Lake Meadow	Trifolium repens	Pasture
Cedar Grove Pack Station	Polypogon australis	Oriole Lake Meadow	Verbascum thapsus	Pasture
Yucca Creek, N. F. Kaweah	Polypogon interruptus	Oriole Lake Road	Bromus tectorum	Road
Ash Mountain Developed Area	Polypogon monspeliensis	Oriole Lake Road	Poa pratensis	Road
Ash Mountain Slash Pit	Polypogon monspeliensis	Oriole Lake Road	Trifolium repens	Road
Cedar Grove Pack Station	Polypogon monspeliensis	Oriole Lake Road	Verbascum thapsus	Road
Hospital Rock	Polypogon monspeliensis	Potwisha Campground	Carduus pycnocephalus	Campground
Middle Fork, Kaweah River	Polypogon monspeliensis	Potwisha Campground	Convolvulus arvensis	Campground
North Fork, Kaweah River	Polypogon monspeliensis	Potwisha Campground	Marrubium vulgare	Campground
Shepherd Saddle Road	Polypogon monspeliensis	Potwisha Campground	Poa bulbosa	Campground
Shepherd Saddle Road	Polypogon monspeliensis	Potwisha Campground	Poa pratensis	Campground
Sycamore Creek, M. F. Kaweah	Polypogon monspeliensis	Potwisha Campground	Ranunculus parviflorus	Campground
Yucca Creek, N. F. Kaweah	Polypogon monspeliensis	Potwisha Campground	Rubus discolor	Campground
Crystal Cave Parking Lot	Prunus persica	Potwisha Campground	Urtica urens	Campground
Ash Mountain Developed Area	Punica granatum	Potwisha Campground	Vinca major	Campground
Grunnigan Ranch	Punica granatum	Potwisha Campground	Vulpia bromoides	Dirt Road
Ash Mountain Developed Area	Pyracantha angustifolia	Rae Lakes Loop Trail	Bromus tectorum	Trail
Grunnigan Ranch	Pyracantha angustifolia	Rae Lakes Loop Trail	Cirsium vulgare	Trail
Middle Fork, Kaweah River	Pyracantha angustifolia	Rae Lakes Loop Trail	Echinochloa crus-galli	Trail
Sycamore Creek, M. F. Kaweah	Pyracantha angustifolia	Rae Lakes Loop Trail	Poa pratensis	Natural
Potwisha Campground	Ranunculus parviflorus	Rae Lakes Loop Trail	Poa pratensis	Pasture
Sentinel Campground	Ranunculus testiculatus	Rae Lakes Loop Trail	Poa pratensis	Riparian
Giant Forest Sewage Plant	Rubus	Rae Lakes Loop Trail	Poa pratensis	Trail
Grunnigan Ranch	Rubus discolor	Rae Lakes Loop Trail	Verbascum thapsus	Riparian
Marble Fork, Kaweah River	Rubus discolor	Rattlesnake Creek Trail	Poa pratensis	Riparian
North Fork, Kaweah River	Rubus discolor	Red Fir Maintenance Area	Bromus tectorum	Development
Potwisha Campground	Rubus discolor	Red Fir Maintenance Area	Cirsium vulgare	Development
Redwood Creek, Mineral King	Rubus discolor	Red Fir Maintenance Area	Poa pratensis	Development
Yucca Creek, N. F. Kaweah	Rubus discolor	Red Fir Maintenance Area	Verbascum virgatum	Development
Old Hidden Springs Road	Silybum marianum	Redwood Canyon Trail	Cirsium vulgare	Trail
Yucca Creek, N. F. Kaweah	Silybum marianum	Redwood Canyon Trail	Trifolium repens	Trail
Generals Highway	Sorghum halepense	Redwood Creek, Mineral King	Bromus tectorum	Development



Site	Exotic Species	Site	Exotic Species	Site Type
Ash Mountain Developed Area	Spartium junceum	Redwood Creek, Mineral King	Poa pratensis	Development
Generals Highway	Spartium junceum	Redwood Creek, Mineral King	Rubus discolor	Development
Middle Fork, Kaweah River	Spartium junceum	Redwood Creek, Mineral King	Trifolium repens	Development
Middle Fork, Kaweah River	Tamarix	Scaffold Meadow	Phleum pratense	Pasture
North Fork, Kaweah River	Tamarix	Scaffold Meadow	Poa pratensis	Pasture
Sycamore Creek, M. F. Kaweah	Tamarix	Sentinel Campground	Ranunculus testiculatus	Campground
Grant Grove Developed Area	Tanacetum parthenium	Sequoia Lake Trail	Cirsium vulgare	Trail
Big Stump Picnic Area	Tragopogon dubius	Sequoia Lake Trail	Poa pratensis	Riparian
Cedar Grove Road	Tragopogon dubius	Sheep Creek Campground	Bromus tectorum	Campground
Crystal Cave Parking Lot	Tragopogon dubius	Sheep Creek Campground	Poa bulbosa	Campground
Dorst Campground	Tragopogon dubius	Sheep Creek Campground	Poa compressa	Campground
Generals Highway	Tragopogon dubius	Sheep Creek Campground	Poa pratensis	Campground
Giant Forest Developed Area	Tragopogon dubius	Shepherd Saddle Road	Polypogon monspeliensis	Development
Halstead Meadow	Tragopogon dubius	Shepherd Saddle Road	Polypogon monspeliensis	Road
South Fork Campground	Tragopogon dubius	South Fork Campground	Carduus pycnocephalus	Campground
Wolverton Pack Station	Tragopogon dubius	South Fork Campground	Cirsium vulgare	Campground
Wuksachi	Tragopogon dubius	South Fork Campground	Tragopogon dubius	Campground
Ash Mountain Developed Area	Trifolium repens	South Fork Campground	Vulpia bromoides	Campground
Atwell Mill Campground	Trifolium repens	Sugarbowl Trail	Bromus tectorum	Natural
Cedar Grove Pack Station	Trifolium repens	Sugarbowl Trail	Cirsium vulgare	Natural
Columbine Picnic Area	Trifolium repens	Sugarloaf Meadow	Poa pratensis	Pasture
Dorst Campground	Trifolium repens	Sunset Campground	Bromus tectorum	Natural
Grant Grove Developed Area	Trifolium repens	Sunset Campground	Cirsium vulgare	Natural
Mineral King Pack Station	Trifolium repens	Sunset Campground	Dactylis glomerata	Natural
Oriole Lake Meadow	Trifolium repens	Sunset Campground	Digitalis purpurea	Natural
Oriole Lake Road	Trifolium repens	Sunset Campground	Poa pratensis	Natural
Redwood Canyon Trail	Trifolium repens	Sunset Campground	Verbascum thapsus	Natural
Redwood Creek, Mineral King	Trifolium repens	Swale Campground	Centaurea solstitialis	Campground
Ash Mountain Slash Pit	Urtica urens	Swale Campground	Cirsium vulgare	Campground
Cedar Grove Pack Station	Urtica urens	Swale Campground	Verbascum thapsus	Campground
Grant Grove Pack Station	Urtica urens	Sycamore Creek, M. F. Kaweah	Arundo donax	Riparian
Mineral King Pack Station	Urtica urens	Sycamore Creek, M. F. Kaweah	Carduus pycnocephalus	Riparian
Potwisha Campground	Urtica urens	Sycamore Creek, M. F. Kaweah	Echinochloa crus-galli	Riparian
Sunset Campground	Verbascum thapsus	Sycamore Creek, M. F. Kaweah	Marrubium vulgare	Riparian
Ash Mountain Developed Area	Verbascum thapsus	Sycamore Creek, M. F. Kaweah	Melilotus indica	Riparian
Azalea Campground	Verbascum thapsus	Sycamore Creek, M. F. Kaweah	Polypogon monspeliensis	Riparian
Camp Conifer	Verbascum thapsus	Sycamore Creek, M. F. Kaweah	Pyracantha angustifolia	Riparian
Cedar Grove Road	Verbascum thapsus	Sycamore Creek, M. F. Kaweah	Tamarix	Riparian
Cold Springs Campground	Verbascum thapsus	Trail For All People	Dactylis glomerata	Trail
Dorst Campground	Verbascum thapsus	Trail For All People	Phleum pratense	Trail
Giant Forest Developed Area	Verbascum thapsus	Traugers Creek, E. F. Kaweah	Lathyrus latifolius	Riparian
Grant Grove Developed Area	Verbascum thapsus	Traugers Creek, E. F. Kaweah	Malus sylvestris	Riparian
Lodgepole Developed Area	Verbascum thapsus	Traugers Creek, E. F. Kaweah	Poa pratensis	Riparian
Mineral King Pack Station	Verbascum thapsus	Williams Meadow	Poa pratensis	Pasture
North Fork, Kaweah River	Verbascum thapsus	Wolverton Pack Station	Tragopogon dubius	Pack Station
Oriole Lake Meadow	Verbascum thapsus	Wolverton Snow Play Area	Poa pratensis	Development
Oriole Lake Road	Verbascum thapsus	Wuksachi	Bromus tectorum	Development
Rae Lakes Loop Trail	Verbascum thapsus	Wuksachi	Cirsium vulgare	Development
Swale Campground	Verbascum thapsus	Wuksachi	Echinochloa crus-galli	Development
Wuksachi	Verbascum thapsus	Wuksachi	Melilotus alba	Development
Zumwalt Meadow Trail	Verbascum thapsus	Wuksachi	Tragopogon dubius	Development
Azalea Campground	Verbascum virgatum	Wuksachi	Verbascum thapsus	Development
Lodgepole Developed Area	Verbascum virgatum	Wuksachi	Verbascum virgatum	Development
Red Fir Maintenance Area	Verbascum virgatum	Yucca Creek, N. F. Kaweah	Carduus pycnocephalus	Riparian
Wuksachi	Verbascum virgatum	Yucca Creek, N. F. Kaweah	Ficus carica	Riparian
Old Hidden Springs Road	Vicia benghalensis	Yucca Creek, N. F. Kaweah	Juglans californica	Riparian
Ash Mountain Developed Area	Vicia sativa	Yucca Creek, N. F. Kaweah	Juglans regia	Riparian
Generals Highway	Vicia sativa	Yucca Creek, N. F. Kaweah	Poa pratensis	Riparian
Generals Highway	Vicia villosa	Yucca Creek, N. F. Kaweah	Polypogon interruptus	Riparian
Ash Mountain Developed Area	Vinca major	Yucca Creek, N. F. Kaweah	Polypogon monspeliensis	Riparian

Site	Exotic Species	Site	Exotic Species	Site Type
Generals Highway	Vinca major	Yucca Creek, N. F. Kaweah	Rubus discolor	Riparian
Potwisha Campground	Vinca major	Yucca Creek, N. F. Kaweah	Silybum marianum	Riparian
Yucca Creek, N. F. Kaweah	Vitis vinifera	Yucca Creek, N. F. Kaweah	Vitis vinifera	Riparian
Crystal Cave Parking Lot	Vulpia bromoides	Zumwalt Meadow Trail	Bromus tectorum	Riparian
Oriole Lake Airstrip	Vulpia bromoides	Zumwalt Meadow Trail	Cirsium vulgare	Riparian
Potwisha Campground	Vulpia bromoides	Zumwalt Meadow Trail	Poa pratensis	Riparian
South Fork Campground	Vulpia bromoides	Zumwalt Meadow Trail	Verbascum thapsus	Riparian

Appendix B. Yosemite National Park - priority exotic species by site.

Site	Exotic Species	Site	Exotic Species	Site Type
The Ahwahnee hotel	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Agrostis gigantea</i>	Development
Backpacker's Camp	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Bromus inermis</i>	Development
Foresta East	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Bromus tectorum</i>	Development
Foresta West	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Dactylis glomerata</i>	Development
Happy Isles	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Erigeron strigosus</i>	Development
Housekeeping Camp	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Holcus lanatus</i>	Development
Lower Pines Campground	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Hypericum perforatum</i>	Development
Lower River Campground	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Lathyrus latifolius</i>	Development
Lower/West Wawona	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Mentha spicata</i>	Development
Meadow Loop Trail - Wawona	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Poa pratensis</i>	Development
Mirror Lake	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Rubus discolor</i>	Development
North Pines Campground	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Rudbeckia hirta</i>	Development
Old Big Oak Flat Rd. Trail	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Trifolium repens</i>	Development
Concession Stables (YV)	<i>Agrostis gigantea</i>	The Ahwahnee hotel	<i>Verbascum thapsus</i>	Development
Snow Creek Trail	<i>Agrostis gigantea</i>	Alder Creek Trail	<i>Bromus tectorum</i>	Trail
Upper Old El Portal	<i>Agrostis gigantea</i>	Alder Creek Trail	<i>Holcus lanatus</i>	Trail
Wawona Middle	<i>Agrostis gigantea</i>	Alder Creek Trail	<i>Hypericum perforatum</i>	Trail
Wawona Road (6051)	<i>Agrostis gigantea</i>	Alder Creek Trail	<i>Poa pratensis</i>	Trail
Wawona Road 3 (6040)	<i>Agrostis gigantea</i>	Backpacker's Camp	<i>Agrostis gigantea</i>	Campground
Yosemite Lodge	<i>Agrostis gigantea</i>	Backpacker's Camp	<i>Bromus tectorum</i>	Campground
Yosemite Loop Trail	<i>Agrostis gigantea</i>	Backpacker's Camp	<i>Cirsium vulgare</i>	Campground
Yosemite Village	<i>Agrostis gigantea</i>	Backpacker's Camp	<i>Holcus lanatus</i>	Campground
Wawona Road (3964)	<i>Agrostis viridis</i>	Backpacker's Camp	<i>Poa pratensis</i>	Campground
Wawona Road (6051)	<i>Agrostis viridis</i>	Backpacker's Camp	<i>Rubus discolor</i>	Campground
Wawona Road 3 (6040)	<i>Agrostis viridis</i>	Backpacker's Camp	<i>Verbascum thapsus</i>	Campground
The Ahwahnee hotel	<i>Bromus inermis</i>	Badger Pass Parking Area	<i>Cirsium vulgare</i>	Development
Curry Village	<i>Bromus inermis</i>	Badger Pass Parking Area	<i>Poa pratensis</i>	Development
Foresta East	<i>Bromus inermis</i>	Badger Pass Parking Area	<i>Verbascum thapsus</i>	Development
Happy Isles	<i>Bromus inermis</i>	Badger Pass Ski Resort	<i>Poa pratensis</i>	Development
Hetch Hetchy Road (5505)	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Bromus tectorum</i>	Road
El Portal Road	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Dactylis glomerata</i>	Road
Housekeeping Camp	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Hypericum perforatum</i>	Road
Lower Old El Portal	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Lathyrus latifolius</i>	Road
Lower River Campground	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Phleum pratense</i>	Road
Lower/West Wawona	<i>Bromus inermis</i>	Big Oak Flat Road (4946)	<i>Poa bulbosa</i>	Road
McCauley Ranch	<i>Bromus inermis</i>	Big Oak Flat Road (5272)	<i>Bromus tectorum</i>	Road
Meadow Loop Trail - Wawona	<i>Bromus inermis</i>	Big Oak Flat Road (5272)	<i>Holcus lanatus</i>	Road
North Pines Campground	<i>Bromus inermis</i>	Big Oak Flat Road (5272)	<i>Poa pratensis</i>	Road
Panorama Trail	<i>Bromus inermis</i>	Big Oak Flat Road (5902)	<i>Bromus tectorum</i>	Road
Concession Stables (YV)	<i>Bromus inermis</i>	Big Oak Flat Road (5902)	<i>Cirsium vulgare</i>	Road
Tioga Road (7981)	<i>Bromus inermis</i>	Bridalveil Campground	<i>Holcus lanatus</i>	Campground
Tuolumne Grove	<i>Bromus inermis</i>	Bridalveil Campground	<i>Poa pratensis</i>	Campground
Upper Old El Portal	<i>Bromus inermis</i>	Bridalveil Creek Trail	<i>Poa pratensis</i>	Trail
Upper Rancheria - El Portal	<i>Bromus inermis</i>	Bridalveil Falls - Inspiration Point	<i>Bromus tectorum</i>	Trail
Wawona Middle	<i>Bromus inermis</i>	Bridalveil Falls - Inspiration Point	<i>Cirsium vulgare</i>	Trail
Wawona Road 2 (5143)	<i>Bromus inermis</i>	Bridalveil Falls - Inspiration Point	<i>Holcus lanatus</i>	Trail
Wawona Road 3 (6040)	<i>Bromus inermis</i>	Bridalveil Falls Trail	<i>Bromus tectorum</i>	Trail
Yosemite Lodge	<i>Bromus inermis</i>	Bridalveil Falls Trail	<i>Poa bulbosa</i>	Trail
Yosemite Village	<i>Bromus inermis</i>	Bridalveil Falls Trail	<i>Poa pratensis</i>	Trail
The Ahwahnee hotel	<i>Bromus tectorum</i>	Chilnaulna Falls Trail	<i>Bromus tectorum</i>	Trail
Alder Creek Trail	<i>Bromus tectorum</i>	Chilnaulna Falls Trail	<i>Holcus lanatus</i>	Trail
Backpacker's Camp	<i>Bromus tectorum</i>	Chilnaulna Falls Trail	<i>Poa compressa</i>	Trail
Big Oak Flat Road (4946)	<i>Bromus tectorum</i>	Crane Flat Campground	<i>Cirsium vulgare</i>	Campground
Big Oak Flat Road (5272)	<i>Bromus tectorum</i>	Crane Flat Campground	<i>Phleum pratense</i>	Campground
Big Oak Flat Road (5902)	<i>Bromus tectorum</i>	Curry Village	<i>Bromus inermis</i>	Development
Bridalveil Falls - Inspiration Point	<i>Bromus tectorum</i>	Curry Village	<i>Cirsium vulgare</i>	Development
Bridalveil Falls Trail	<i>Bromus tectorum</i>	Curry Village	<i>Dactylis glomerata</i>	Development
Chilnaulna Falls Trail	<i>Bromus tectorum</i>	Curry Village	<i>Holcus lanatus</i>	Development

Site	Exotic Species	Site	Exotic Species	Site Type
Foresta East	<i>Bromus tectorum</i>	Curry Village	<i>Lolium perenne</i>	Development
Foresta West	<i>Bromus tectorum</i>	Curry Village	<i>Phleum pratense</i>	Development
Four-mile Trail	<i>Bromus tectorum</i>	Curry Village	<i>Poa pratensis</i>	Development
Government Stables	<i>Bromus tectorum</i>	Curry Village	<i>Rubus discolor</i>	Development
Happy Isles	<i>Bromus tectorum</i>	Curry Village	<i>Trifolium repens</i>	Development
Hetch Hetchy Backpacker's Camp	<i>Bromus tectorum</i>	Foresta East	<i>Agrostis gigantea</i>	Development
Hetch Hetchy Corral	<i>Bromus tectorum</i>	Foresta East	<i>Bromus inermis</i>	Development
Hetch Hetchy Road (5505)	<i>Bromus tectorum</i>	Foresta East	<i>Bromus tectorum</i>	Development
El Portal Road	<i>Bromus tectorum</i>	Foresta East	<i>Centaurea maculosa</i>	Development
Inspiration Pt. Trail	<i>Bromus tectorum</i>	Foresta East	<i>Centaurea solstitialis</i>	Development
Lower Old El Portal	<i>Bromus tectorum</i>	Foresta East	<i>Cirsium vulgare</i>	Development
Lower Pines Campground	<i>Bromus tectorum</i>	Foresta East	<i>Digitalis purpurea</i>	Development
Lower River Campground	<i>Bromus tectorum</i>	Foresta East	<i>Holcus lanatus</i>	Development
Lower/West Wawona	<i>Bromus tectorum</i>	Foresta East	<i>Lathyrus latifolius</i>	Development
McCauley Ranch	<i>Bromus tectorum</i>	Foresta East	<i>Leucanthemum vulgare</i>	Development
Meadow Loop Trail - Wawona	<i>Bromus tectorum</i>	Foresta East	<i>Poa pratensis</i>	Development
Mirror Lake	<i>Bromus tectorum</i>	Foresta East	<i>Tragopogon dubius</i>	Development
Mirror Lake Pack Trail	<i>Bromus tectorum</i>	Foresta East	<i>Trifolium repens</i>	Development
North Pines Campground	<i>Bromus tectorum</i>	Foresta West	<i>Agrostis gigantea</i>	Development
Northside Drive	<i>Bromus tectorum</i>	Foresta West	<i>Bromus tectorum</i>	Development
Old Big Oak Flat Rd. Trail	<i>Bromus tectorum</i>	Foresta West	<i>Cirsium vulgare</i>	Development
Panorama Trail	<i>Bromus tectorum</i>	Foresta West	<i>Holcus lanatus</i>	Development
Concession Stables (YV)	<i>Bromus tectorum</i>	Foresta West	<i>Leucanthemum vulgare</i>	Development
Snow Creek Trail	<i>Bromus tectorum</i>	Foresta West	<i>Lolium perenne</i>	Development
Southside Drive	<i>Bromus tectorum</i>	Foresta West	<i>Poa pratensis</i>	Development
Sunnyside Campground	<i>Bromus tectorum</i>	Foresta West	<i>Tragopogon dubius</i>	Development
Tioga Road (4661)	<i>Bromus tectorum</i>	Foresta West	<i>Verbascum thapsus</i>	Development
Tioga Road (8472)	<i>Bromus tectorum</i>	Four-mile Trail	<i>Bromus tectorum</i>	Trail
Two Hour Trail	<i>Bromus tectorum</i>	Four-mile Trail	<i>Holcus lanatus</i>	Trail
Upper East Wawona	<i>Bromus tectorum</i>	Four-mile Trail	<i>Poa bulbosa</i>	Trail
Upper Pines Campground	<i>Bromus tectorum</i>	Four-mile Trail	<i>Poa pratensis</i>	Trail
Upper Rancheria - El Portal	<i>Bromus tectorum</i>	Glacier Point Road (6440)	<i>Cirsium vulgare</i>	Road
Wawona Stables	<i>Bromus tectorum</i>	Glen Aulin High Sierra Camp	<i>Poa pratensis</i>	Camp
Wawona Campground	<i>Bromus tectorum</i>	Glen Aulin High Sierra Camp	<i>Trifolium repens</i>	Camp
Wawona Middle	<i>Bromus tectorum</i>	Glen Aulin Trail	<i>Poa pratensis</i>	Trail
Wawona Road (3964)	<i>Bromus tectorum</i>	Glen Aulin Trail	<i>Trifolium repens</i>	Trail
Wawona Road (6051)	<i>Bromus tectorum</i>	Government Corrals - Tuolumne	<i>Poa pratensis</i>	Stock
Wawona Road 2 (5143)	<i>Bromus tectorum</i>	Government Stables	<i>Bromus tectorum</i>	Stock
Wawona Road 3 (6040)	<i>Bromus tectorum</i>	Government Stables	<i>Poa bulbosa</i>	Stock
Yosemite Falls Trail	<i>Bromus tectorum</i>	Government Stables	<i>Urtica urens</i>	Stock
Yosemite Lodge	<i>Bromus tectorum</i>	Happy Isles	<i>Agrostis gigantea</i>	Trail
Yosemite Loop Trail	<i>Bromus tectorum</i>	Happy Isles	<i>Bromus inermis</i>	Trail
Yosemite Village	<i>Bromus tectorum</i>	Happy Isles	<i>Bromus tectorum</i>	Trail
Yosemite West	<i>Bromus tectorum</i>	Happy Isles	<i>Cirsium vulgare</i>	Trail
Lower River Campground	<i>Carduus pycnocephalus</i>	Happy Isles	<i>Holcus lanatus</i>	Trail
Foresta East	<i>Centaurea maculosa</i>	Happy Isles	<i>Marrubium vulgare</i>	Trail
Foresta East	<i>Centaurea solstitialis</i>	Happy Isles	<i>Poa pratensis</i>	Trail
Hetch Hetchy Corral	<i>Centaurea solstitialis</i>	Harden Lake Corral	<i>Poa pratensis</i>	Stock
Lower Old El Portal	<i>Centaurea solstitialis</i>	Harden Lake Corral	<i>Trifolium repens</i>	Stock
McCauley Ranch	<i>Centaurea solstitialis</i>	Hetch Hetchy Backpacker's Camp	<i>Bromus tectorum</i>	Campground
Upper Old El Portal	<i>Centaurea solstitialis</i>	Hetch Hetchy Backpacker's Camp	<i>Hypericum perforatum</i>	Campground
Upper Rancheria - El Portal	<i>Centaurea solstitialis</i>	Hetch Hetchy Backpacker's Camp	<i>Melilotus alba</i>	Campground
Wawona Road 2 (5143)	<i>Centaurea solstitialis</i>	Hetch Hetchy Backpacker's Camp	<i>Melilotus indica</i>	Campground
Backpacker's Camp	<i>Cirsium vulgare</i>	Hetch Hetchy Backpacker's Camp	<i>Poa bulbosa</i>	Campground
Badger Pass Parking Area	<i>Cirsium vulgare</i>	Hetch Hetchy Backpacker's Camp	<i>Poa pratensis</i>	Campground
Big Oak Flat Road (5902)	<i>Cirsium vulgare</i>	Hetch Hetchy Backpacker's Camp	<i>Tragopogon dubius</i>	Campground
Bridalveil Falls - Inspiration Point	<i>Cirsium vulgare</i>	Hetch Hetchy Corral	<i>Bromus tectorum</i>	Stock
Crane Flat Campground	<i>Cirsium vulgare</i>	Hetch Hetchy Corral	<i>Centaurea solstitialis</i>	Stock
Curry Village	<i>Cirsium vulgare</i>	Hetch Hetchy Corral	<i>Poa bulbosa</i>	Stock

Site	Exotic Species	Site	Exotic Species	Site Type
Foresta East	<i>Cirsium vulgare</i>	Hetch Hetchy Corral	<i>Poa pratensis</i>	Stock
Foresta West	<i>Cirsium vulgare</i>	Hetch Hetchy Road (5505)	<i>Bromus inermis</i>	Road
Glacier Point Road (6440)	<i>Cirsium vulgare</i>	Hetch Hetchy Road (5505)	<i>Bromus tectorum</i>	Road
Happy Isles	<i>Cirsium vulgare</i>	Hetch Hetchy Road (5505)	<i>Hypericum perforatum</i>	Road
Hogdon Meadow Campground	<i>Cirsium vulgare</i>	EI Portal Road	<i>Bromus inermis</i>	Road
Housekeeping Camp	<i>Cirsium vulgare</i>	EI Portal Road	<i>Bromus tectorum</i>	Road
Lower Pines Campground	<i>Cirsium vulgare</i>	EI Portal Road	<i>Poa bulbosa</i>	Road
Lower/West Wawona	<i>Cirsium vulgare</i>	EI Portal Road	<i>Poa pratensis</i>	Road
Mariposa Grove - Lower Grove	<i>Cirsium vulgare</i>	Hogdon Meadow Campground	<i>Cirsium vulgare</i>	Campground
Mariposa Grove - Upper	<i>Cirsium vulgare</i>	Hogdon Meadow Campground	<i>Holcus lanatus</i>	Campground
McCauley Ranch	<i>Cirsium vulgare</i>	Hogdon Meadow Campground	<i>Phleum pratense</i>	Campground
Meadow Loop Trail - Wawona	<i>Cirsium vulgare</i>	Hogdon Meadow Campground	<i>Poa pratensis</i>	Campground
Mirror Lake	<i>Cirsium vulgare</i>	Hogdon Meadow Campground	<i>Tragopogon dubius</i>	Campground
Mirror Lake Pack Trail	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Agrostis gigantea</i>	Development
North Pines Campground	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Bromus inermis</i>	Development
Old Big Oak Flat Rd. Trail	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Cirsium vulgare</i>	Development
Panorama Trail	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Dactylis glomerata</i>	Development
Concession Stables (YV)	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Holcus lanatus</i>	Development
Southside Drive	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Lolium perenne</i>	Development
Tioga Road (6254)	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Rubus discolor</i>	Development
Two Hour Trail	<i>Cirsium vulgare</i>	Housekeeping Camp	<i>Verbascum thapsus</i>	Development
Upper East Wawona	<i>Cirsium vulgare</i>	Inspiration Pt. Trail	<i>Bromus tectorum</i>	Trail
Upper Pines Campground	<i>Cirsium vulgare</i>	Inspiration Pt. Trail	<i>Scorzonera hispanica</i>	Trail
Wawona Campground	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Bromus inermis</i>	Development
Wawona Middle	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Bromus tectorum</i>	Development
Wawona Road (6051)	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Centaurea solstitialis</i>	Development
Wawona Road 2 (5143)	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Coreopsis lanceolata</i>	Development
Wawona Road 3 (6040)	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Marrubium vulgare</i>	Development
Yosemite Lodge	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Melilotus alba</i>	Development
Yosemite Loop Trail	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Melilotus indica</i>	Development
Yosemite Village	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Mentha spicata</i>	Development
Yosemite West	<i>Cirsium vulgare</i>	Lower Old EI Portal	<i>Rubus discolor</i>	Development
McCauley Ranch	<i>Convolvulus arvensis</i>	Lower Old EI Portal	<i>Tragopogon dubius</i>	Development
Upper Old EI Portal	<i>Convolvulus arvensis</i>	Lower Old EI Portal	<i>Trifolium repens</i>	Development
Yosemite Village	<i>Convolvulus arvensis</i>	Lower Old EI Portal	<i>Verbascum thapsus</i>	Development
Lower Old EI Portal	<i>Coreopsis lanceolata</i>	Lower Old EI Portal	<i>Vinca major</i>	Development
The Ahwahnee hotel	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Agrostis gigantea</i>	Campground
Big Oak Flat Road (4946)	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Bromus tectorum</i>	Campground
Curry Village	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Cirsium vulgare</i>	Campground
Housekeeping Camp	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Dactylis glomerata</i>	Campground
Lower Pines Campground	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Holcus lanatus</i>	Campground
Lower River Campground	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Phleum pratense</i>	Campground
Lower/West Wawona	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Poa bulbosa</i>	Campground
Meadow Loop Trail - Wawona	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Poa pratensis</i>	Campground
Merced Grove trail	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Rubus discolor</i>	Campground
Mirror Lake	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Rubus laciniatus</i>	Campground
Northside Drive	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Trifolium repens</i>	Campground
Concession Stables (YV)	<i>Dactylis glomerata</i>	Lower Pines Campground	<i>Verbascum thapsus</i>	Campground
Southside Drive	<i>Dactylis glomerata</i>	Lower River Campground	<i>Agrostis gigantea</i>	Campground
Tioga Road (6254)	<i>Dactylis glomerata</i>	Lower River Campground	<i>Bromus inermis</i>	Campground
Tuolumne Concessions Stables	<i>Dactylis glomerata</i>	Lower River Campground	<i>Bromus tectorum</i>	Campground
Upper East Wawona	<i>Dactylis glomerata</i>	Lower River Campground	<i>Carduus pycnocephalus</i>	Campground
Upper Old EI Portal	<i>Dactylis glomerata</i>	Lower River Campground	<i>Dactylis glomerata</i>	Campground
Upper Pines Campground	<i>Dactylis glomerata</i>	Lower River Campground	<i>Foeniculum vulgare</i>	Campground
Wawona Middle	<i>Dactylis glomerata</i>	Lower River Campground	<i>Geranium robertianum</i>	Campground
Yosemite Lodge	<i>Dactylis glomerata</i>	Lower River Campground	<i>Holcus lanatus</i>	Campground
Foresta East	<i>Digitalis purpurea</i>	Lower River Campground	<i>Hypericum perforatum</i>	Campground
Lower/West Wawona	<i>Digitalis purpurea</i>	Lower River Campground	<i>Lolium perenne</i>	Campground
Upper East Wawona	<i>Digitalis purpurea</i>	Lower River Campground	<i>Marrubium vulgare</i>	Campground

Site	Exotic Species	Site	Exotic Species	Site Type
Wawona Middle	<i>Digitalis purpurea</i>	Lower River Campground	<i>Melilotus alba</i>	Campground
The Ahwahnee hotel	<i>Erigeron strigosus</i>	Lower River Campground	<i>Poa bulbosa</i>	Campground
Lower River Campground	<i>Foeniculum vulgare</i>	Lower River Campground	<i>Poa pratensis</i>	Campground
Lower River Campground	<i>Geranium robertianum</i>	Lower River Campground	<i>Rubus discolor</i>	Campground
Yosemite Village	<i>Hedera helix</i>	Lower River Campground	<i>Scorzonera hispanica</i>	Campground
The Ahwahnee hotel	<i>Holcus lanatus</i>	Lower River Campground	<i>Tragopogon dubius</i>	Campground
Alder Creek Trail	<i>Holcus lanatus</i>	Lower River Campground	<i>Trifolium repens</i>	Campground
Backpacker's Camp	<i>Holcus lanatus</i>	Lower River Campground	<i>Verbascum thapsus</i>	Campground
Big Oak Flat Road (5272)	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Agrostis gigantea</i>	Development
Bridalveil Campground	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Bromus inermis</i>	Development
Bridalveil Falls - Inspiration Point	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Bromus tectorum</i>	Development
Chilnaulna Falls Trail	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Cirsium vulgare</i>	Development
Curry Village	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Dactylis glomerata</i>	Development
Foresta East	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Digitalis purpurea</i>	Development
Foresta West	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Holcus lanatus</i>	Development
Four-mile Trail	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Lolium perenne</i>	Development
Happy Isles	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Phleum pratense</i>	Development
Hogdon Meadow Campground	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Poa bulbosa</i>	Development
Housekeeping Camp	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Poa pratensis</i>	Development
Lower Pines Campground	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Tanacetum parthenium</i>	Development
Lower River Campground	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Trifolium repens</i>	Development
Lower/West Wawona	<i>Holcus lanatus</i>	Lower/West Wawona	<i>Verbascum thapsus</i>	Development
Mariposa Grove - Lower Grove	<i>Holcus lanatus</i>	Mariposa Grove - Lower Grove	<i>Cirsium vulgare</i>	Development
McCauley Ranch	<i>Holcus lanatus</i>	Mariposa Grove - Lower Grove	<i>Holcus lanatus</i>	Development
Meadow Loop Trail - Wawona	<i>Holcus lanatus</i>	Mariposa Grove - Lower Grove	<i>Poa pratensis</i>	Development
Mirror Lake	<i>Holcus lanatus</i>	Mariposa Grove - Lower Grove	<i>Verbascum thapsus</i>	Development
Mirror Lake Pack Trail	<i>Holcus lanatus</i>	Mariposa Grove - Upper	<i>Cirsium vulgare</i>	Development
North Pines Campground	<i>Holcus lanatus</i>	Mariposa Grove - Upper	<i>Poa pratensis</i>	Development
Old Big Oak Flat Rd. Trail	<i>Holcus lanatus</i>	McCauley Ranch	<i>Bromus inermis</i>	Stock
Concession Stables (YV)	<i>Holcus lanatus</i>	McCauley Ranch	<i>Bromus tectorum</i>	Stock
Tioga Road (4661)	<i>Holcus lanatus</i>	McCauley Ranch	<i>Centaurea solstitialis</i>	Stock
Two Hour Trail	<i>Holcus lanatus</i>	McCauley Ranch	<i>Cirsium vulgare</i>	Stock
Upper East Wawona	<i>Holcus lanatus</i>	McCauley Ranch	<i>Convolvulus arvensis</i>	Stock
Upper Pines Campground	<i>Holcus lanatus</i>	McCauley Ranch	<i>Holcus lanatus</i>	Stock
Wawona Stables	<i>Holcus lanatus</i>	McCauley Ranch	<i>Hypericum perforatum</i>	Stock
Wawona Campground	<i>Holcus lanatus</i>	McCauley Ranch	<i>Phleum pratense</i>	Stock
Wawona Middle	<i>Holcus lanatus</i>	McCauley Ranch	<i>Poa pratensis</i>	Stock
Wawona Road (3964)	<i>Holcus lanatus</i>	McCauley Ranch	<i>Rubus discolor</i>	Stock
Wawona Road (6051)	<i>Holcus lanatus</i>	McCauley Ranch	<i>Tragopogon dubius</i>	Stock
Yosemite Falls Trail	<i>Holcus lanatus</i>	McCauley Ranch	<i>Trifolium repens</i>	Stock
Yosemite Lodge	<i>Holcus lanatus</i>	McCauley Ranch	<i>Verbascum thapsus</i>	Stock
Yosemite Loop Trail	<i>Holcus lanatus</i>	Meadow Loop Trail - Wawona	<i>Agrostis gigantea</i>	Trail
Yosemite Village	<i>Holcus lanatus</i>	Meadow Loop Trail - Wawona	<i>Bromus inermis</i>	Trail
The Ahwahnee hotel	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Bromus tectorum</i>	Trail
Alder Creek Trail	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Cirsium vulgare</i>	Trail
Big Oak Flat Road (4946)	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Dactylis glomerata</i>	Trail
Hetch Hetchy Backpacker's Camp	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Holcus lanatus</i>	Trail
Hetch Hetchy Road (5505)	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Lathyrus latifolius</i>	Trail
Lower River Campground	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Phleum pratense</i>	Trail
McCauley Ranch	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Poa bulbosa</i>	Trail
Northside Drive	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Poa pratensis</i>	Trail
Concession Stables (YV)	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Rubus discolor</i>	Trail
Tioga Road (4661)	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Rubus laciniatus</i>	Trail
Wawona Road (3964)	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Tragopogon dubius</i>	Trail
Yosemite Falls Trail	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Trifolium repens</i>	Trail
Yosemite Loop Trail	<i>Hypericum perforatum</i>	Meadow Loop Trail - Wawona	<i>Verbascum thapsus</i>	Trail
Yosemite Village	<i>Hypericum perforatum</i>	Merced Grove trail	<i>Dactylis glomerata</i>	Trail
The Ahwahnee hotel	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Agrostis gigantea</i>	Development
Big Oak Flat Road (4946)	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Bromus tectorum</i>	Development

Site	Exotic Species	Site	Exotic Species	Site Type
Foresta East	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Cirsium vulgare</i>	Development
Meadow Loop Trail - Wawona	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Dactylis glomerata</i>	Development
Upper Old El Portal	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Holcus lanatus</i>	Development
Upper Rancheria - El Portal	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Poa pratensis</i>	Development
Wawona Middle	<i>Lathyrus latifolius</i>	Mirror Lake	<i>Rubus discolor</i>	Development
Yosemite Village	<i>Lathyrus latifolius</i>	Mirror Lake Pack Trail	<i>Bromus tectorum</i>	Trail
Yosemite West	<i>Leucanthemum maximum</i>	Mirror Lake Pack Trail	<i>Cirsium vulgare</i>	Trail
Foresta East	<i>Leucanthemum vulgare</i>	Mirror Lake Pack Trail	<i>Holcus lanatus</i>	Trail
Foresta West	<i>Leucanthemum vulgare</i>	Mirror Lake Pack Trail	<i>Phleum pratense</i>	Trail
North Pines Campground	<i>Leucanthemum vulgare</i>	Mirror Lake Pack Trail	<i>Poa pratensis</i>	Trail
Concession Stables (YV)	<i>Leucanthemum vulgare</i>	Mirror Lake Pack Trail	<i>Rubus discolor</i>	Trail
Upper East Wawona	<i>Leucanthemum vulgare</i>	Mirror Lake Pack Trail	<i>Trifolium repens</i>	Trail
Wawona Middle	<i>Leucanthemum vulgare</i>	North Pines Campground	<i>Agrostis gigantea</i>	Campground
Yosemite Lodge	<i>Leucanthemum vulgare</i>	North Pines Campground	<i>Bromus inermis</i>	Campground
Curry Village	<i>Lolium perenne</i>	North Pines Campground	<i>Bromus tectorum</i>	Campground
Foresta West	<i>Lolium perenne</i>	North Pines Campground	<i>Cirsium vulgare</i>	Campground
Housekeeping Camp	<i>Lolium perenne</i>	North Pines Campground	<i>Holcus lanatus</i>	Campground
Lower River Campground	<i>Lolium perenne</i>	North Pines Campground	<i>Leucanthemum vulgare</i>	Campground
Lower/West Wawona	<i>Lolium perenne</i>	North Pines Campground	<i>Lolium perenne</i>	Campground
North Pines Campground	<i>Lolium perenne</i>	North Pines Campground	<i>Poa bulbosa</i>	Campground
Northside Drive	<i>Lolium perenne</i>	North Pines Campground	<i>Poa pratensis</i>	Campground
Concession Stables (YV)	<i>Lolium perenne</i>	North Pines Campground	<i>Rubus discolor</i>	Campground
Southside Drive	<i>Lolium perenne</i>	North Pines Campground	<i>Rubus laciniatus</i>	Campground
Upper East Wawona	<i>Lolium perenne</i>	North Pines Campground	<i>Verbascum thapsus</i>	Campground
Upper Old El Portal	<i>Lolium perenne</i>	Northside Drive	<i>Bromus tectorum</i>	Road
Upper Rancheria - El Portal	<i>Lolium perenne</i>	Northside Drive	<i>Dactylis glomerata</i>	Road
Wawona Middle	<i>Lolium perenne</i>	Northside Drive	<i>Hypericum perforatum</i>	Road
Yosemite Lodge	<i>Lolium perenne</i>	Northside Drive	<i>Lolium perenne</i>	Road
Yosemite Village	<i>Lolium perenne</i>	Northside Drive	<i>Poa bulbosa</i>	Road
Yosemite West	<i>Lolium perenne</i>	Northside Drive	<i>Poa pratensis</i>	Road
Happy Isles	<i>Marrubium vulgare</i>	Northside Drive	<i>Tragopogon dubius</i>	Road
Lower Old El Portal	<i>Marrubium vulgare</i>	Northside Drive	<i>Trifolium repens</i>	Road
Lower River Campground	<i>Marrubium vulgare</i>	Old Big Oak Flat Rd. Trail	<i>Agrostis gigantea</i>	Trail
Upper Old El Portal	<i>Marrubium vulgare</i>	Old Big Oak Flat Rd. Trail	<i>Bromus tectorum</i>	Trail
Upper Rancheria - El Portal	<i>Marrubium vulgare</i>	Old Big Oak Flat Rd. Trail	<i>Cirsium vulgare</i>	Trail
Hetch Hetchy Backpacker's Camp	<i>Melilotus alba</i>	Old Big Oak Flat Rd. Trail	<i>Holcus lanatus</i>	Trail
Lower Old El Portal	<i>Melilotus alba</i>	Old Big Oak Flat Rd. Trail	<i>Tragopogon dubius</i>	Trail
Lower River Campground	<i>Melilotus alba</i>	Panorama Trail	<i>Bromus inermis</i>	Trail
Hetch Hetchy Backpacker's Camp	<i>Melilotus indica</i>	Panorama Trail	<i>Bromus tectorum</i>	Trail
Lower Old El Portal	<i>Melilotus indica</i>	Panorama Trail	<i>Cirsium vulgare</i>	Trail
Upper Old El Portal	<i>Melilotus indica</i>	Concession Stables (YV)	<i>Agrostis gigantea</i>	Stock
Upper Rancheria - El Portal	<i>Melilotus officinalis</i>	Concession Stables (YV)	<i>Bromus inermis</i>	Stock
The Ahwahnee hotel	<i>Mentha spicata</i>	Concession Stables (YV)	<i>Bromus tectorum</i>	Stock
Lower Old El Portal	<i>Mentha spicata</i>	Concession Stables (YV)	<i>Cirsium vulgare</i>	Stock
Big Oak Flat Road (4946)	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Dactylis glomerata</i>	Stock
Crane Flat Campground	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Holcus lanatus</i>	Stock
Curry Village	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Hypericum perforatum</i>	Stock
Hogdon Meadow Campground	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Leucanthemum vulgare</i>	Stock
Lower Pines Campground	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Lolium perenne</i>	Stock
Lower/West Wawona	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Phleum pratense</i>	Stock
McCauley Ranch	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Poa bulbosa</i>	Stock
Meadow Loop Trail - Wawona	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Poa pratensis</i>	Stock
Mirror Lake Pack Trail	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Rubus discolor</i>	Stock
Concession Stables (YV)	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Tragopogon dubius</i>	Stock
Tioga Road (4661)	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Trifolium repens</i>	Stock
Yosemite Loop Trail	<i>Phleum pratense</i>	Concession Stables (YV)	<i>Verbascum thapsus</i>	Stock
Big Oak Flat Road (4946)	<i>Poa bulbosa</i>	Snow Creek Trail	<i>Agrostis gigantea</i>	Trail
Bridalveil Falls Trail	<i>Poa bulbosa</i>	Snow Creek Trail	<i>Bromus tectorum</i>	Trail
Four-mile Trail	<i>Poa bulbosa</i>	Snow Creek Trail	<i>Poa pratensis</i>	Trail

Site	Exotic Species	Site	Exotic Species	Site Type
Government Stables	<i>Poa bulbosa</i>	Southside Drive	<i>Bromus tectorum</i>	Road
Hetch Hetchy Backpacker's Camp	<i>Poa bulbosa</i>	Southside Drive	<i>Cirsium vulgare</i>	Road
Hetch Hetchy Corral	<i>Poa bulbosa</i>	Southside Drive	<i>Dactylis glomerata</i>	Road
El Portal Road	<i>Poa bulbosa</i>	Southside Drive	<i>Lolium perenne</i>	Road
Lower Pines Campground	<i>Poa bulbosa</i>	Southside Drive	<i>Poa bulbosa</i>	Road
Lower River Campground	<i>Poa bulbosa</i>	Southside Drive	<i>Poa pratensis</i>	Road
Lower/West Wawona	<i>Poa bulbosa</i>	Southside Drive	<i>Tragopogon dubius</i>	Road
Meadow Loop Trail - Wawona	<i>Poa bulbosa</i>	Southside Drive	<i>Trifolium repens</i>	Road
North Pines Campground	<i>Poa bulbosa</i>	Southside Drive	<i>Verbascum thapsus</i>	Road
Northside Drive	<i>Poa bulbosa</i>	Sunnyside Campground	<i>Bromus tectorum</i>	Campground
Concession Stables (YV)	<i>Poa bulbosa</i>	Sunnyside Campground	<i>Poa bulbosa</i>	Campground
Southside Drive	<i>Poa bulbosa</i>	Tamarack Flat Campground	<i>Poa pratensis</i>	Campground
Sunnyside Campground	<i>Poa bulbosa</i>	Tamarack Flat Campground	<i>Trifolium repens</i>	Campground
Tioga Road (4661)	<i>Poa bulbosa</i>	Tioga Road (4661)	<i>Bromus tectorum</i>	Road
Upper East Wawona	<i>Poa bulbosa</i>	Tioga Road (4661)	<i>Holcus lanatus</i>	Road
Upper Pines Campground	<i>Poa bulbosa</i>	Tioga Road (4661)	<i>Hypericum perforatum</i>	Road
Wawona Stables	<i>Poa bulbosa</i>	Tioga Road (4661)	<i>Phleum pratense</i>	Road
Wawona Campground	<i>Poa bulbosa</i>	Tioga Road (4661)	<i>Poa bulbosa</i>	Road
Wawona Middle	<i>Poa bulbosa</i>	Tioga Road (6254)	<i>Cirsium vulgare</i>	Road
Wawona Road (3964)	<i>Poa bulbosa</i>	Tioga Road (6254)	<i>Dactylis glomerata</i>	Road
Yosemite Lodge	<i>Poa bulbosa</i>	Tioga Road (7981)	<i>Bromus inermis</i>	Road
Yosemite Loop Trail	<i>Poa bulbosa</i>	Tioga Road (8472)	<i>Bromus tectorum</i>	Road
Yosemite Village	<i>Poa bulbosa</i>	Tuolumne Concessions Stables	<i>Dactylis glomerata</i>	Stock
Chilnaulna Falls Trail	<i>Poa compressa</i>	Tuolumne Concessions Stables	<i>Poa pratensis</i>	Stock
The Ahwahnee hotel	<i>Poa pratensis</i>	Tuolumne Concessions Stables	<i>Trifolium repens</i>	Stock
Alder Creek Trail	<i>Poa pratensis</i>	Tuolumne Grove	<i>Bromus inermis</i>	Development
Backpacker's Camp	<i>Poa pratensis</i>	Two Hour Trail	<i>Bromus tectorum</i>	Trail
Badger Pass Parking Area	<i>Poa pratensis</i>	Two Hour Trail	<i>Cirsium vulgare</i>	Trail
Badger Pass Ski Resort	<i>Poa pratensis</i>	Two Hour Trail	<i>Holcus lanatus</i>	Trail
Big Oak Flat Road (5272)	<i>Poa pratensis</i>	Two Hour Trail	<i>Poa pratensis</i>	Trail
Bridalveil Campground	<i>Poa pratensis</i>	Upper East Wawona	<i>Bromus tectorum</i>	Development
Bridalveil Creek Trail	<i>Poa pratensis</i>	Upper East Wawona	<i>Cirsium vulgare</i>	Development
Bridalveil Falls Trail	<i>Poa pratensis</i>	Upper East Wawona	<i>Dactylis glomerata</i>	Development
Curry Village	<i>Poa pratensis</i>	Upper East Wawona	<i>Digitalis purpurea</i>	Development
Foresta East	<i>Poa pratensis</i>	Upper East Wawona	<i>Holcus lanatus</i>	Development
Foresta West	<i>Poa pratensis</i>	Upper East Wawona	<i>Leucanthemum vulgare</i>	Development
Four-mile Trail	<i>Poa pratensis</i>	Upper East Wawona	<i>Lolium perenne</i>	Development
Glen Aulin High Sierra Camp	<i>Poa pratensis</i>	Upper East Wawona	<i>Poa bulbosa</i>	Development
Glen Aulin Trail	<i>Poa pratensis</i>	Upper East Wawona	<i>Poa pratensis</i>	Development
Government Corrals - Tuolumne	<i>Poa pratensis</i>	Upper East Wawona	<i>Rubus discolor</i>	Development
Happy Isles	<i>Poa pratensis</i>	Upper East Wawona	<i>Trifolium repens</i>	Development
Harden Lake Corral	<i>Poa pratensis</i>	Upper East Wawona	<i>Verbascum thapsus</i>	Development
Hetch Hetchy Backpacker's Camp	<i>Poa pratensis</i>	Upper Old El Portal	<i>Agrostis gigantea</i>	Development
Hetch Hetchy Corral	<i>Poa pratensis</i>	Upper Old El Portal	<i>Bromus inermis</i>	Development
El Portal Road	<i>Poa pratensis</i>	Upper Old El Portal	<i>Centaurea solstitialis</i>	Development
Hogdon Meadow Campground	<i>Poa pratensis</i>	Upper Old El Portal	<i>Convolvulus arvensis</i>	Development
Lower Pines Campground	<i>Poa pratensis</i>	Upper Old El Portal	<i>Dactylis glomerata</i>	Development
Lower River Campground	<i>Poa pratensis</i>	Upper Old El Portal	<i>Lathyrus latifolius</i>	Development
Lower/West Wawona	<i>Poa pratensis</i>	Upper Old El Portal	<i>Lolium perenne</i>	Development
Mariposa Grove - Lower Grove	<i>Poa pratensis</i>	Upper Old El Portal	<i>Marrubium vulgare</i>	Development
Mariposa Grove - Upper	<i>Poa pratensis</i>	Upper Old El Portal	<i>Melilotus indica</i>	Development
McCauley Ranch	<i>Poa pratensis</i>	Upper Old El Portal	<i>Rubus discolor</i>	Development
Meadow Loop Trail - Wawona	<i>Poa pratensis</i>	Upper Old El Portal	<i>Tragopogon dubius</i>	Development
Mirror Lake	<i>Poa pratensis</i>	Upper Old El Portal	<i>Trifolium repens</i>	Development
Mirror Lake Pack Trail	<i>Poa pratensis</i>	Upper Old El Portal	<i>Verbascum thapsus</i>	Development
North Pines Campground	<i>Poa pratensis</i>	Upper Old El Portal	<i>Vinca major</i>	Development
Northside Drive	<i>Poa pratensis</i>	Upper Pines Campground	<i>Bromus tectorum</i>	Campground
Concession Stables (YV)	<i>Poa pratensis</i>	Upper Pines Campground	<i>Cirsium vulgare</i>	Campground
Snow Creek Trail	<i>Poa pratensis</i>	Upper Pines Campground	<i>Dactylis glomerata</i>	Campground



Site	Exotic Species	Site	Exotic Species	Site Type
Southside Drive	<i>Poa pratensis</i>	Upper Pines Campground	<i>Holcus lanatus</i>	Campground
Tamarack Flat Campground	<i>Poa pratensis</i>	Upper Pines Campground	<i>Poa bulbosa</i>	Campground
Tuolumne Concessions Stables	<i>Poa pratensis</i>	Upper Pines Campground	<i>Poa pratensis</i>	Campground
Two Hour Trail	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Bromus inermis</i>	Development
Upper East Wawona	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Bromus tectorum</i>	Development
Upper Pines Campground	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Centaurea solstitialis</i>	Development
Upper Rancheria - El Portal	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Lathyrus latifolius</i>	Development
Wawona Stables	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Lolium perenne</i>	Development
Wawona Campground	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Marrubium vulgare</i>	Development
Wawona Middle	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Melilotus officinalis</i>	Development
Wawona Road (3964)	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Poa pratensis</i>	Development
Wawona Road (6051)	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Rubus discolor</i>	Development
Wawona Road 2 (5143)	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Tragopogon dubius</i>	Development
Wawona Road 3 (6040)	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Trifolium repens</i>	Development
White Wolf Corral	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Verbascum thapsus</i>	Development
Yosemite Lodge	<i>Poa pratensis</i>	Upper Rancheria - El Portal	<i>Vicia benghalensis</i>	Development
Yosemite Loop Trail	<i>Poa pratensis</i>	Wawona Stables	<i>Bromus tectorum</i>	Stock
Yosemite Village	<i>Poa pratensis</i>	Wawona Stables	<i>Holcus lanatus</i>	Stock
Yosemite West	<i>Poa pratensis</i>	Wawona Stables	<i>Poa bulbosa</i>	Stock
Young Lake Trail	<i>Poa pratensis</i>	Wawona Stables	<i>Poa pratensis</i>	Stock
The Ahwahnee hotel	<i>Rubus discolor</i>	Wawona Campground	<i>Bromus tectorum</i>	Campground
Backpacker's Camp	<i>Rubus discolor</i>	Wawona Campground	<i>Cirsium vulgare</i>	Campground
Curry Village	<i>Rubus discolor</i>	Wawona Campground	<i>Holcus lanatus</i>	Campground
Housekeeping Camp	<i>Rubus discolor</i>	Wawona Campground	<i>Poa bulbosa</i>	Campground
Lower Old El Portal	<i>Rubus discolor</i>	Wawona Campground	<i>Poa pratensis</i>	Campground
Lower Pines Campground	<i>Rubus discolor</i>	Wawona Campground	<i>Rubus laciniatus</i>	Campground
Lower River Campground	<i>Rubus discolor</i>	Wawona Campground	<i>Verbascum thapsus</i>	Campground
McCauley Ranch	<i>Rubus discolor</i>	Wawona Campground	<i>Vitis vinifera</i>	Campground
Meadow Loop Trail - Wawona	<i>Rubus discolor</i>	Wawona Middle	<i>Agrostis gigantea</i>	Development
Mirror Lake	<i>Rubus discolor</i>	Wawona Middle	<i>Bromus inermis</i>	Development
Mirror Lake Pack Trail	<i>Rubus discolor</i>	Wawona Middle	<i>Bromus tectorum</i>	Development
North Pines Campground	<i>Rubus discolor</i>	Wawona Middle	<i>Cirsium vulgare</i>	Development
Concession Stables (YV)	<i>Rubus discolor</i>	Wawona Middle	<i>Dactylis glomerata</i>	Development
Upper East Wawona	<i>Rubus discolor</i>	Wawona Middle	<i>Digitalis purpurea</i>	Development
Upper Old El Portal	<i>Rubus discolor</i>	Wawona Middle	<i>Holcus lanatus</i>	Development
Upper Rancheria - El Portal	<i>Rubus discolor</i>	Wawona Middle	<i>Lathyrus latifolius</i>	Development
Yosemite Lodge	<i>Rubus discolor</i>	Wawona Middle	<i>Leucanthemum vulgare</i>	Development
Yosemite Loop Trail	<i>Rubus discolor</i>	Wawona Middle	<i>Lolium perenne</i>	Development
Yosemite Village	<i>Rubus discolor</i>	Wawona Middle	<i>Poa bulbosa</i>	Development
Lower Pines Campground	<i>Rubus laciniatus</i>	Wawona Middle	<i>Poa pratensis</i>	Development
North Pines Campground	<i>Rubus laciniatus</i>	Wawona Middle	<i>Verbascum thapsus</i>	Development
Wawona Campground	<i>Rubus laciniatus</i>	Wawona Road (3964)	<i>Agrostis viridis</i>	Road
Meadow Loop Trail - Wawona	<i>Rubus laciniatus</i>	Wawona Road (3964)	<i>Bromus tectorum</i>	Road
The Ahwahnee hotel	<i>Rudbeckia hirta</i>	Wawona Road (3964)	<i>Holcus lanatus</i>	Road
Inspiration Pt. Trail	<i>Scorzonera hispanica</i>	Wawona Road (3964)	<i>Hypericum perforatum</i>	Road
Lower River Campground	<i>Scorzonera hispanica</i>	Wawona Road (3964)	<i>Poa bulbosa</i>	Road
Lower/West Wawona	<i>Tanacetum parthenium</i>	Wawona Road (3964)	<i>Poa pratensis</i>	Road
Foresta East	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Agrostis gigantea</i>	Road
Foresta West	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Agrostis viridis</i>	Road
Hetch Hetchy Backpacker's Camp	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Bromus tectorum</i>	Road
Hogdon Meadow Campground	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Cirsium vulgare</i>	Road
Lower Old El Portal	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Holcus lanatus</i>	Road
Lower River Campground	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Poa pratensis</i>	Road
McCauley Ranch	<i>Tragopogon dubius</i>	Wawona Road (6051)	<i>Trifolium repens</i>	Road
Meadow Loop Trail - Wawona	<i>Tragopogon dubius</i>	Wawona Road 2 (5143)	<i>Bromus inermis</i>	Road
Northside Drive	<i>Tragopogon dubius</i>	Wawona Road 2 (5143)	<i>Bromus tectorum</i>	Road
Old Big Oak Flat Rd. Trail	<i>Tragopogon dubius</i>	Wawona Road 2 (5143)	<i>Centaurea solstitialis</i>	Road
Concession Stables (YV)	<i>Tragopogon dubius</i>	Wawona Road 2 (5143)	<i>Cirsium vulgare</i>	Road
Southside Drive	<i>Tragopogon dubius</i>	Wawona Road 2 (5143)	<i>Poa pratensis</i>	Road

Site	Exotic Species	Site	Exotic Species	Site Type
Upper Old El Portal	<i>Tragopogon dubius</i>	Wawona Road 3 (6040)	<i>Agrostis gigantea</i>	Road
Upper Rancheria - El Portal	<i>Tragopogon dubius</i>	Wawona Road 3 (6040)	<i>Agrostis viridis</i>	Road
Wawona Road 3 (6040)	<i>Tragopogon dubius</i>	Wawona Road 3 (6040)	<i>Bromus inermis</i>	Road
Yosemite Loop Trail	<i>Tragopogon dubius</i>	Wawona Road 3 (6040)	<i>Bromus tectorum</i>	Road
The Ahwahnee hotel	<i>Trifolium repens</i>	Wawona Road 3 (6040)	<i>Cirsium vulgare</i>	Road
Curry Village	<i>Trifolium repens</i>	Wawona Road 3 (6040)	<i>Poa pratensis</i>	Road
Foresta East	<i>Trifolium repens</i>	Wawona Road 3 (6040)	<i>Tragopogon dubius</i>	Road
Glen Aulin High Sierra Camp	<i>Trifolium repens</i>	White Wolf Corral	<i>Poa pratensis</i>	Stock
Glen Aulin Trail	<i>Trifolium repens</i>	White Wolf Corral	<i>Trifolium repens</i>	Stock
Harden Lake Corral	<i>Trifolium repens</i>	Yosemite Falls Trail	<i>Bromus tectorum</i>	Trail
Lower Old El Portal	<i>Trifolium repens</i>	Yosemite Falls Trail	<i>Holcus lanatus</i>	Trail
Lower Pines Campground	<i>Trifolium repens</i>	Yosemite Falls Trail	<i>Hypericum perforatum</i>	Trail
Lower River Campground	<i>Trifolium repens</i>	Yosemite Lodge	<i>Agrostis gigantea</i>	Development
Lower/West Wawona	<i>Trifolium repens</i>	Yosemite Lodge	<i>Bromus inermis</i>	Development
McCauley Ranch	<i>Trifolium repens</i>	Yosemite Lodge	<i>Bromus tectorum</i>	Development
Meadow Loop Trail - Wawona	<i>Trifolium repens</i>	Yosemite Lodge	<i>Cirsium vulgare</i>	Development
Mirror Lake Pack Trail	<i>Trifolium repens</i>	Yosemite Lodge	<i>Dactylis glomerata</i>	Development
Northside Drive	<i>Trifolium repens</i>	Yosemite Lodge	<i>Holcus lanatus</i>	Development
Concession Stables (YV)	<i>Trifolium repens</i>	Yosemite Lodge	<i>Leucanthemum vulgare</i>	Development
Southside Drive	<i>Trifolium repens</i>	Yosemite Lodge	<i>Lolium perenne</i>	Development
Tamarack Flat Campground	<i>Trifolium repens</i>	Yosemite Lodge	<i>Poa bulbosa</i>	Development
Tuolumne Concessions Stables	<i>Trifolium repens</i>	Yosemite Lodge	<i>Poa pratensis</i>	Development
Upper East Wawona	<i>Trifolium repens</i>	Yosemite Lodge	<i>Rubus discolor</i>	Development
Upper Old El Portal	<i>Trifolium repens</i>	Yosemite Lodge	<i>Verbascum thapsus</i>	Development
Upper Rancheria - El Portal	<i>Trifolium repens</i>	Yosemite Loop Trail	<i>Agrostis gigantea</i>	Trail
Wawona Road (6051)	<i>Trifolium repens</i>	Yosemite Loop Trail	<i>Bromus tectorum</i>	Trail
White Wolf Corral	<i>Trifolium repens</i>	Yosemite Loop Trail	<i>Cirsium vulgare</i>	Trail
Yosemite West	<i>Trifolium repens</i>	Yosemite Loop Trail	<i>Holcus lanatus</i>	Trail
Government Stables	<i>Urtica urens</i>	Yosemite Loop Trail	<i>Hypericum perforatum</i>	Trail
The Ahwahnee hotel	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Phleum pratense</i>	Trail
Backpacker's Camp	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Poa bulbosa</i>	Trail
Badger Pass Parking Area	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Poa pratensis</i>	Trail
Foresta West	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Rubus discolor</i>	Trail
Housekeeping Camp	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Tragopogon dubius</i>	Trail
Lower Old El Portal	<i>Verbascum thapsus</i>	Yosemite Loop Trail	<i>Verbascum thapsus</i>	Trail
Lower Pines Campground	<i>Verbascum thapsus</i>	Yosemite Village	<i>Agrostis gigantea</i>	Development
Lower River Campground	<i>Verbascum thapsus</i>	Yosemite Village	<i>Bromus inermis</i>	Development
Lower/West Wawona	<i>Verbascum thapsus</i>	Yosemite Village	<i>Bromus tectorum</i>	Development
Mariposa Grove - Lower Grove	<i>Verbascum thapsus</i>	Yosemite Village	<i>Cirsium vulgare</i>	Development
McCauley Ranch	<i>Verbascum thapsus</i>	Yosemite Village	<i>Convolvulus arvensis</i>	Development
Meadow Loop Trail - Wawona	<i>Verbascum thapsus</i>	Yosemite Village	<i>Hedera helix</i>	Development
North Pines Campground	<i>Verbascum thapsus</i>	Yosemite Village	<i>Holcus lanatus</i>	Development
Concession Stables (YV)	<i>Verbascum thapsus</i>	Yosemite Village	<i>Hypericum perforatum</i>	Development
Southside Drive	<i>Verbascum thapsus</i>	Yosemite Village	<i>Lathyrus latifolius</i>	Development
Upper East Wawona	<i>Verbascum thapsus</i>	Yosemite Village	<i>Lolium perenne</i>	Development
Upper Old El Portal	<i>Verbascum thapsus</i>	Yosemite Village	<i>Poa bulbosa</i>	Development
Upper Rancheria - El Portal	<i>Verbascum thapsus</i>	Yosemite Village	<i>Poa pratensis</i>	Development
Wawona Campground	<i>Verbascum thapsus</i>	Yosemite Village	<i>Rubus discolor</i>	Development
Wawona Middle	<i>Verbascum thapsus</i>	Yosemite Village	<i>Vitis vinifera</i>	Development
Yosemite Lodge	<i>Verbascum thapsus</i>	Yosemite West	<i>Bromus tectorum</i>	Road
Yosemite Loop Trail	<i>Verbascum thapsus</i>	Yosemite West	<i>Cirsium vulgare</i>	Road
Yosemite West	<i>Verbascum thapsus</i>	Yosemite West	<i>Leucanthemum maximum</i>	Road
Upper Rancheria - El Portal	<i>Vicia benghalensis</i>	Yosemite West	<i>Lolium perenne</i>	Road
Lower Old El Portal	<i>Vinca major</i>	Yosemite West	<i>Poa pratensis</i>	Road
Upper Old El Portal	<i>Vinca major</i>	Yosemite West	<i>Trifolium repens</i>	Road
Wawona Campground	<i>Vitis vinifera</i>	Yosemite West	<i>Verbascum thapsus</i>	Road
Yosemite Village	<i>Vitis vinifera</i>	Young Lake Trail	<i>Poa pratensis</i>	Trail

Appendix C. Field notes of Sequoia-Kings Canyon National Park survey crews.

**Ash Mountain Headquarters**

*Ampelopsis arborea* One population, apparently a residual planting, was found near house #97 in the headquarters area. This population of approximately a dozen individuals was growing near the foundation of an erstwhile structure, now an open grassy area.

*Arundo donax* A large clump approximately 5 meters by 10 meters was observed along the far western edge of the large maintenance parking lot. A large, straggling colony grew on an exposed, grassy slope in the back yard of house #14.

*Carduus pycnocephalus* Thousands of these plants grew in many places around Ash Mountain, especially in shaded or moist grassy areas.

*Cistus* sp. One planted population of approximately 10 individuals was observed adjacent to the Administration Building; this was the only population observed within the Ash Mountain area.

*Dactylis glomerata* Thousands of plants grew in the shaded, unmowed lawn of Quarters 96. This is the only population observed in the Ash Mountain area in 1997 and 1998.

*Eucalyptus citriodora* One plant was found on an exposed grassy slope bordering a dirt parking lot on the east side of Highway 198. This tree had been chopped down and was resprouting from the base.

*Festuca arundinacea* Collected in lawn between the Research Office and the Sequoia Natural History Association Building in the Ash Mountain Headquarters. One colony, consisting of a few dozen plants, was found 50 meters north of the footbridge at the western edge of crescent meadow in a level, moist, shaded area.

*Genista monspessulana* Thousands of these plants were scattered widely about Ash Mountain Headquarters. Very few individuals appeared more than a few years old, likely due to eradication efforts by park employees. One especially dense colony hosted over 1000 individuals and was located 15 meters northeast of the laundry room under a dense canopy of *Quercus wislizenii* var *wislizenii*. Most common in partly shaded grassy areas, this species appeared well dispersed around headquarters, but we did not see any outside of this developed area.

*Hedera helix* Cultivated in several places about Ash Mountain Headquarters, this species does not appear to have naturalized.

*Heteromeles arbutifolia* This species is native to much of California, but not to the Kaweah River drainage. It is widely planted and naturalized around Ash Mountain Headquarters, with thousands of plants sighted during the surveys. It was common in grassy areas in all sunlight regimes. Very few plants were seen outside of the developed areas.

*Lathyrus latifolius* One colony of several dozen plants grew at headquarters in an open grassy field bounded on all sides by structures and roadways. This population was likely a residual planting.

*Leucosium aestivum* Hundreds of plants grew about the Research Center in unwatered flowerbeds and in adjacent unwatered grassy areas. This species appears to reproduce sexually and asexually in this area. This is the first collection for Sequoia-Kings Canyon National Parks.

*Ligustrum sinense* Dozens of privet hedges are cultivated in landscaped areas about Ash Mountain Headquarters. None appear to be naturalizing.

*Melilotus indica* These plants grew in a few scattered populations, mainly along grassy roadsides in the Ash Mountain Complex. No more than a few dozen individuals were sighted in the entire survey area.

*Poa bulbosa* Dozens of plants grew 15 meters northwest of Quarters 9 in an exposed, flat, disturbed, sandy parking lot. Thousands of plants grew throughout Ash Mountain in partly shaded, disturbed, grassy areas.

*Poa pratensis* We found fewer than ten plants in an irregularly watered lawn near the Research Office, Ash Mountain Headquarters. Observed only in the headquarters area, this plant was seen by the hundreds in a watered lawn just north of the Administration Building.

*Polypogon monspeliensis* Collected in the Ash Mountain Headquarters parking lot. It has been seen elsewhere in more naturalized areas such as Alder Creek and the Ash Mountain pastures.

*Oxalis pes-caprae* Thousands of plants grew five meters southwest of the Research Center in a gently sloping, north-facing, grassy area around a concrete-lined pond. Colonies of this plant are common about the Ash Mountain developed area.

*Punica granatum* One plant was found growing alongside a footpath leading down to the Middle Fork of the Kaweah River. It appeared to be more than 20 years old and had no offspring visible near it. It seems unlikely that this plant was intentionally cultivated.

*Pyracantha angustifolia* Hundreds of individuals were scattered about the headquarters area in grassy places. This widely planted species appears to naturalize in watered and unwatered areas alike. Naturalized individuals observed during the Ash Mountain surveys were limited to the Headquarters area. Two other naturalized plants were seen in nearby riparian areas, one in Sycamore Creek and one in the Middle Fork of the Kaweah River, just upstream of headquarters (see associated survey reports).

*Spartium junceum* This plant has several distinct populations throughout the Ash Mountain area as well as along the Middle Fork of the Kaweah near the park boundary. A single population of fewer than one hundred individuals was found along the north side of the Generals Highway on a steep road cut fifty meters west of the Alder Creek bridge. Another population was seen in the lower Ash Mountain housing area near residence #88's garage. One mature shrub with several smaller shrubs are here. Other scattered individuals are infrequent throughout the Ash Mountain survey area.

*Trifolium repens* Thousands of plants grew in the watered lawn surrounding the Administration Building.

*Vicia sativa* A single, small colony was observed near Cricket Hollow along an old asphalt use road that parallels the Generals Highway on the north side. Two other colonies were observed in the Ash Mountain area adjacent to the Generals Highway. Three populations of this plant were observed in the Ash Mountain area. All were on partly shaded, grassy slopes bordering roadways. There were hundreds of plants in each colony.

*Vinca major* Numerous patches (on the order of several square meters each) of this plant were scattered about and restricted to the Ash Mountain Headquarters area. All appear to be either maintained or residual plantings.

### **Ash Mountain Entrance Station**

*Catalpa bignonioides* One tree grew alongside a road/parking area within 100 meters of the park boundary on the west side of the Kaweah River. It appeared to have been planted there; its trunk was about 50 centimeters in diameter at 1.7 meters above the ground.

## Ash Mountain Flume

*Medicago sativa* Three hardy, vegetative plants were observed within 200 meters of each other along the flume. All grew in shade on or alongside the footpath.

## Ash Mountain Slash Pits

*Urtica urens* Fewer than ten plants grew at the south end of the Ash Mountain Slash Pits on exposed, disturbed soil bordering human waste compost.

## Atwell Mill Campground

*Poa pratensis* Thousands of individuals were scattered throughout the campground in undisturbed, moist soils.

*Trifolium repens* A population of greater than 1000 individuals was seen growing in a wet seep with a dense herbaceous layer in well developed, saturated soil. No other populations were observed throughout the campground.

## Azalea Campground

*Bromus tectorum* Several small populations, totaling fewer than 100 plants, grew in the southwest part of the campground in a disturbed, partly shaded meadow margin.

*Cirsium vulgare* Hundreds of rosettes were scattered in moist places throughout the campground.

*Holcus lanatus* Thousands of plants grew in moist, disturbed places about the campground.

*Phalaris arundinacea* A population of over 100 individuals was observed 20 meters west of the SW corner of Azalea Campground in the center of an undisturbed montane meadow. The population was growing out of a rotting fallen log that was in standing water. This is the wettest site that this species was observed growing in 1998. Scattered small patches were observed in moist sites within the campground as well. Dozens of plants grew in a level, sunny, disturbed seep in the middle of the campground.

*Poa bulbosa* Fewer than ten plants grew in the southwest part of the campground in a disturbed, partly shaded meadow margin.

*Poa pratensis* Hundreds of plants were scattered in moist places about Azalea Campground.

*Verbascum thapsus* We observed one population containing dozens of plants in a lush, disturbed, partly shaded seep.

*Verbascum virgatum* Dozens of plants grew in a moist, flat, disturbed, sunny area near the middle of the campground.

## Big Stump Picnic Area

*Bromus tectorum* Thousands of plants grew throughout the parking area in sandy, disturbed soils.

*Poa pratensis* Dozens of plants grew throughout the parking area in sandy, disturbed soils.

*Tragopogon dubius* One plant grew near the entrance to the Big Stump Parking Area in sandy, disturbed soil.

## **Buckeye Campground**

*Bromus tectorum* Thousands of these plants grew in sunny areas on the east side of the campground.

*Poa bulbosa* This species was widespread about the campground in disturbed and undisturbed, open areas. It was especially common around campground the perimeter where grassland began.

*Marrubium vulgare* Thousands of these plants grew in dense patches in the southern part of the campground.

## **Calhoon Meadow**

*Poa pratensis* A small population of fewer than 10 individuals was seen growing in Calhoon Meadow adjacent to a 10 m deep, cut stream bank. No other populations were seen in this meadow.

## **Camp Conifer**

*Bromus tectorum* This was from a 1 x 2 square meter colony in a exposed roadside area on the old road leading up to Camp Conifer.

*Poa compressa* This plant was part of a small colony that was growing on a moist, old dirt roadbed near Camp Conifer.

*Verbascum thapsus* This plant was scattered sparsely in wet, old dirt roadbeds around Camp Conifer.

## **Cedar Grove Market and Lodge**

*Bromus tectorum* Tens of thousands of plants grew in open places throughout the market area. This species is abundant in the Cedar Grove Valley and does not appear to be restricted to human disturbance.

*Melilotus alba* A single population consisting of fewer than 100 plants grew in exposed, sandy, trampled soil adjacent to the laundromat.

*Poa bulbosa* Hundreds of plants grew about the market area in sandy soils. They appeared to be restricted to human disturbance.

*Poa pratensis* We found one population containing hundreds of individuals near the laundromat in exposed, sandy soil. The soil appeared damp due to leaky plumbing.

## **Cedar Grove Pack Station**

*Bromus tectorum* Tens of thousands of these plants infested every habitable patch of soil in and around the pack station. They were abundant in many parts of the Cedar Grove area, apparently not restricted to human disturbance.

*Phalaris minor* One plant grew alongside a corral in partly shaded, grassy, disturbed duff on a gentle, south-facing slope. First collection for Sequoia-Kings Canyon National Parks.

*Poa bulbosa* Thousands of these plants grew on dirt roadbeds and margins of highly disturbed areas about the pack station. This species appeared restricted to the pack station complex.

*Polypogon australis* Dozens of individuals grew in the silty manure of an exposed, unused corral 40 meters north of the tack shed.

*Polypogon monspeliensis* There were a few small, scattered patches of this species in the less trampled areas of the pack station complex.

*Trifolium repens* We found one plant at the south end of the pack station in shaded, trampled, mesic duff.

*Urtica urens* We saw dozens of these plants in two small populations near the corral margins in manure-enriched soil. This species appeared restricted to the pack station complex.

### **Cedar Grove Road**

*Bromus tectorum* Thousands of plants grew in open, sunny places throughout the survey area. This species is abundant throughout the Cedar Grove Valley and does not seem restricted to human disturbance.

*Cirsium vulgare* Dozens of plants grew in moist places along the Cedar Grove Road. They did not appear to be restricted to human disturbance.

*Festuca arundinacea* Hundreds of plants grew along the south side of the Cedar Grove Road, two kilometers west of Road's End. They were restricted to the roadside and grew in moderately shaded, decomposed granite soil.

*Holcus lanatus* A single, large colony stretched approximately 50 meters along the south side of the road. The population was growing in well-drained, disturbed, granitic soil. We did not observe any individuals further than 5 meters from the road.

*Lolium perenne* Three clumps were observed within 25 meters of one another approximately 2 kilometers east of the Roaring River Bridge on the south side of the road. They were growing adjacent to the road in sandy, disturbed soil.

*Poa bulbosa* We found one colony of hundreds of plants alongside a sunny parking lot in decomposed granite soil 100 meters northeast of the Roaring River Bridge.

*Poa pratensis* Hundreds of plants grew in moist, shaded, well-vegetated, decomposed granite soil three kilometers west of Road's End.

*Tragopogon dubius* We saw dozens of these plants scattered far and wide in many sunlight and moisture regimes. They did not appear to be restricted to human disturbance.

*Verbascum thapsus* Hundreds of vegetative plants grew along the south side of the Cedar Grove Road in exposed, decomposed granite soil 300 meters east northeast of the Roaring River Bridge. This species appeared to be restricted to the road margin.

### **Cherry Flat Trail**

*Poa bulbosa* We found one population along the trail from Cherry Flat to Redwood Creek. Dozens of plants grew in a steep, partly shaded, sandy trailside area.

### **Cold Springs Campground**

*Digitalis purpurea* A population of fewer than 1000 individuals was observed growing on the north side of the bridge leading to the campground. Much of the population was growing in a watered, manicured lawn. Many individuals were scattered near the lawn in less disturbed, unwatered sites. The cabin next to the lawn had a wooden sign: "The Wollenmans".

*Poa pratensis* Fewer than 1000 individuals were seen scattered throughout the campground in moist roadsides.

*Verbascum thapsus* A single vegetative individual was seen on the west end of the campground adjacent to the walk-in campsite parking area. It was growing in moderately disturbed, well drained, granitic soil. No other individuals were observed throughout the campground.

### **Colony Mill Road**

*Bromus tectorum* Dozens of individuals growing directly on the roadbed near the gate that marks the Sequoia National Park Boundary. Several hundred individuals were observed scattered along the road corridor in open, disturbed, compacted soil.

*Carduus pycnocephalus* Thousands of individuals growing directly on the roadbed near the gate that marks the Sequoia National Park Boundary.

*Morus alba* One tree was growing in a stream alongside the lower end of the Colony Mill Road. The trunk diameter at 1.7 meters was approximately 60 centimeters.

### **Columbine Picnic Area**

*Cirsium vulgare* Hundreds of plants grew in a partly shaded ecotone between white fir forest and montane meadow. This area was moderately disturbed, gently sloping, west-facing, and well vegetated.

*Dactylis glomerata* One colony of thousands of individuals grew on a stream bank in the Columbine Picnic Area.

*Phalaris arundinacea* Hundreds of plants grew in the north edge of the picnic area in a well vegetated, partly shaded seep adjacent to a trail. This is likely *Agrostis gigantea* but we are unsure yet.

*Poa pratensis* Thousands of plants grew in a partly shaded ecotone between white fir forest and montane meadow. This area was gently sloping, west-facing, and well vegetated. This plant was not restricted to disturbed places.

*Trifolium repens* Hundreds of plants grew in a partly shaded ecotone between white fir forest and montane meadow. This area was moderately disturbed, gently sloping, west-facing, and well vegetated.

### **Crescent Meadow Trail**

*Festuca pratensis* One colony, consisting of a few dozen plants, was found 50 meters north of the footbridge at the western edge of crescent meadow in a level, moist, shaded area.

*Phleum pratense* There were several individuals observed along the west edge of Crescent Meadow growing out of rock cracks and compacted disturbed soil. There are scattered individuals all throughout the meadow margin. Another small population was observed at Round Meadow. A single population of fewer than 10 individuals was observed on the west margin of Crescent Meadow in a moderately disturbed, moist, partly shaded area.

*Poa pratensis* Thousands of individuals were observed throughout the meadow in both open and shaded areas.

### **Crystal Cave Parking Lot**

*Bromus tectorum* Fewer than 1000 individuals were found along the edges of the parking lot in disturbed, partly shaded soils.



*Prunus persica* This is almost surely the cultivated peach. Four trees grew around the periphery of the parking lot. Two of the trees appeared to have been planted and the other two were saplings, growing near the mature ones.

*Tragopogon dubius* Fewer than 100 individuals were seen growing near the entrance of the parking lot along the road.

*Vulpia bromoides* Fewer than 1000 individuals were found growing along the edges of the parking lot in disturbed, partly shaded soils.

### **Crystal Cave Road**

*Echinochloa crus-galli* Along the north edge of the Crystal Cave road on a well-drained, south facing, sunny slope. This site burned in 1969.

### **Crystal Springs Campground**

*Cirsium vulgare* Hundreds of plants were scattered throughout Crystal Springs Campground, most commonly in moist, meadow margins.

*Poa pratensis* Hundreds of plants grew throughout the campground in both moist, disturbed and moist, undisturbed areas.

### **Deadman Canyon Trail**

*Poa pratensis* Hundreds of plants grew on a sunny stream bank alongside a trail 150 meters southeast of the Roaring River Ranger Station.

### **Dorst Campground**

*Cirsium vulgare* A population of several hundred individuals was observed on a gently sloping, south-facing hillside with well drained, sandy, granitic soils with a moderately dense herbaceous layer. No other populations were observed growing in the survey area.

*Dactylis glomerata* Six plants were found on the east side of the campground near the entrance/registration station. They were growing around the concrete base of a recreational vehicle dump station in disturbed, partly shaded, decomposed granite soil. They were clearly receiving anthropogenic water.

*Festuca arundinacea* One clump was found along a well vegetated, partly shaded roadside near the middle of the campground. First collection for Sequoia-Kings Canyon National Parks.

*Melilotus alba* Fewer than 100 mature plants were scattered throughout the campground in the late fall. The plants were observed in open areas with sparse herbaceous under story. There were numerous seedlings of this species scattered throughout the area.

*Melilotus officinalis* A late-season survey revealed one plant growing in the partly shaded, gently sloping, east-facing, disturbed soil of a campsite near the Amphitheater. This is the first collection for Sequoia-Kings Canyon National Parks.

*Poa pratensis* Two populations of fewer than 100 individuals were found growing along the edge of a wet montane meadow in moist, well developed soil.

*Tragopogon dubius* Hundreds of individuals were seen scattered throughout the campground.

*Trifolium repens* Fewer than 1000 individuals were seen scattered throughout the campground in open, dry, disturbed, sandy areas.

*Verbascum thapsus* Fewer than 1000 individuals were encountered throughout the campground. Most of the plants were seen on disturbed soils adjacent to roads and trails.

### **Elk Creek Trail, Middle Fork Kaweah**

*Carduus pycnocephalus* This was collected from a 6 m x 10 m patch. The patch was located in an open area surrounded by dense *Adenostoma fasciculatum* along the Chamise Creek Trail.

### **Eli's Paradise Meadow**

*Dactylis glomerata* In Giant Forest at Eli's Paradise Meadow (Sunset Campground).

*Digitalis purpurea* Many hundreds of these plants grew in Eli's Paradise, a montane meadow about 500 meters northwest of Round Meadow. They were especially common along the broad southeast margin of the meadow, where there was little standing water.

### **Ferguson Creek Area**

*Cirsium vulgare* This montane meadow, which is 2.5 kilometers east of Sugarloaf Peak, had hundreds of plants scattered throughout it.

### **General's Highway**

*Centaurea solstitialis* Three plants grew along the east side of the Generals Highway one kilometer south of Potwisha Campground. About a dozen plants were eradicated between Potwisha Campground and Ash Mountain immediately following detection of these individuals. All grew along the east side of the road in fresh fill dirt, presumably imported during road construction in 1997. A follow-up survey of the entire road between Ash Mountain and Potwisha was done within the week by Resource Management staff. During their search, they encountered another six individuals scattered along the road. In December another individual was found at this location that had already set seed. There is a potential that there will be more individuals at this location and along the road for the next few years.

*Dactylis glomerata* Two hundred meters west of The Wye along the Generals Highway; single population of 6 individuals adjacent to the south edge of the highway in sandy, well-drained soil.

*Melilotus indica* Thousands of these plants grew throughout the road corridor in loose soil. They were not common in the surrounding undisturbed grassland.

*Oxalis pes-caprae* Thousands of plants grew on a road-cut 125 meters north of the Ash Mountain Visitor Center. This 30 meter section of roadside was the only place we saw *Oxalis* between Ash Mountain and Potwisha Campground.

*Phalaris paradoxa* Two distinct populations of approximately one hundred individuals each were observed adjacent to the Generals Highway in the vicinity of the Ash Mt. Entrance Station. Both populations are located adjacent to the roadway in open, moist seeps. A single individual was also observed between the Middle Fork Flume and the parking lot/staging area below the entrance station.

*Sorghum halepense* Dozens of plants were seen in a colony on an exposed roadside area 1.5 kilometers south along the Generals Highway from Amphitheater Point.

*Spartium junceum* Dozens of plants grew in one distinct colony about 75 meters north of the Ash Mountain Visitor Center. This roadside colony appears to have originated from Ash Mountain government housing, just upslope from the road.

*Tragopogon dubius* One plant was found alongside the Generals Highway across from the former lodging area in a partly shaded dirt "pull-out". Five individuals were seen growing where the Generals Highway bisects Halstead Meadow in a sandy berm. All five plants were pulled up.

*Vicia sativa* Several plants grew 125 meters north of the Ash Mountain Visitor Center along the west edge of the Generals Highway on a steep, east-facing road cut. We saw thousands more along the General's Highway.

*Vicia villosa* One plant grew along the east side of the Generals Highway 1.5 kilometers south of Potwisha Campground. This roadside has been re-vegetated following last year's road construction. Another individual grew under similar conditions 1 kilometer north.

*Vinca major* We saw one dense 75 square meter colony 100 meters north of the Ash Mountain Visitor Center. It grew along the shaded south bank of Alder Creek near the west margin of the Generals Highway.

### **Giant Forest Developed Area**

*Dactylis glomerata* A population of fewer than 10 individuals was observed growing along the road to Lower Kaweah Housing on the west side of the Giant Forest Lodge in partly disturbed, partly shaded, sandy, granitic soil. Other populations of this plant were seen in Giant Forest at Eli's Paradise Meadow (Sunset Campground) and at Round Meadow. Thousands of individuals were seen scattered throughout the meadow edge, primarily on the west and north edges along the "Trail for All People". The plants radiate into the adjacent Big Tree Forest for several meters. Other populations of this species were observed along the asphalt road to Lower Kaweah on the west side of the Giant Forest Lodge.

*Digitalis purpurea* Many hundreds of these plants grew in Eli's Paradise, a montane meadow about 500 meters northwest of Round Meadow. They were especially common along the broad southeast margin of the meadow, where there was little standing water. A single plant was seen growing adjacent to the asphalt roadway leading to the Puzzle Tree on a steep road cut in well-drained, granitic soil with a sparse duff layer.

*Poa bulbosa* A colony of fewer than 100 individuals was seen growing directly in front of the Giant Forest Lodge adjacent to a dirt footpath in moderately disturbed, partly shaded, well developed soil

*Poa pratensis* A population of fewer than 100 individuals was seen growing in front of the Giant Forest Lodge adjacent to concrete steps in partly shaded ground. There are frequent populations throughout Giant Forest in moist, undisturbed sites.

*Tragopogon dubius* One plant was found alongside the Generals Highway across from the former lodging area in a partly shaded dirt "pull-out".

*Verbascum thapsus* A single rosette was seen growing in front of the Giant Forest Lodge in partly shaded, disturbed soil.

### **Giant Forest Sewage Plant**

*Bromus tectorum* Thousands of individuals were seen growing around the Giant Forest Sewage Treatment Facility in open, poorly developed and well developed soils. No other populations were seen in the Giant Forest area.

*Cirsium vulgare* A single plant was observed near the Giant Forest Sewage Treatment Facility. There were abundant individuals scattered throughout Giant Forest in both disturbed and undisturbed sites.

*Rubus* sp. One robust colony grew at the base of a sewage treatment structure in 50% shade. It is likely a cultivated species dispersed by feces.

## Grant Grove Developed Area

*Cirsium vulgare* One rosette grew on a gently sloping, south-facing, disturbed meadow margin near the market.

*Digitalis purpurea* Hundreds of plants grew in the housing area and in the adjacent forested areas in more mesic, undisturbed sites.

*Holcus lanatus* A large colony of over 1000 individuals was observed approximately 50 meters north of Grant Grove Market in an open, moderately disturbed, level site between an asphalt road and moist montane meadow.

*Phalaris arundinacea* Thousands of plants grew in a partly shaded stream 50 meters south of Wilsonia. These plants were abundant in many streams about Grant Grove, often dominating herbaceous cover. This appears to be *Agrostis gigantea* but final identification is pending. A large colony of several thousand individuals were observed along the north edge of the meadow behind the Grant Grove Market. The population was growing along the meadow margin in disturbed, sandy soil. This is the only population observed in this meadow. There are several other populations of this species throughout the Grant Grove Area. A small clump of three individuals was observed 40 meters east of the Maintenance Building/Fire House on a berm adjacent to the large parking lot. Thousands of plants grew in dense colonies in many wet areas about Grant Grove.

*Phleum pratense* Hundreds of plants grew on the east edge of the market area on a trampled, partly shaded meadow margin.

*Poa pratensis* Hundreds of plants grew on the east edge of the market area on a trampled, partly shaded meadow margin. This species was scattered throughout the survey area in moist places. Hundreds of plants grew about the housing area and they were common on meadow margins.

*Tanacetum parthenium* A single plant was observed in an exposed, nearly flat clearing within the Wilsonia area in loose, disturbed soil.

*Trifolium repens* Hundreds of plants grew throughout the Grant Grove developed area in clumps scattered about disturbed, moist places.

*Verbascum thapsus* Dozens of plants were scattered throughout the housing area. Fewer than ten individuals were observed 40 meters east of the Maintenance Building/Fire House on a berm adjacent to the large parking lot.

## Grant Grove Pack Station

*Phalaris arundinacea* Dozens of plants grew at the northwest edge of the pack station in partly shaded duff and horse manure. They appeared to be restricted to anthropogenic disturbance. Dozens of plants grew at the south end of the pack station in a densely vegetated unused corral.

*Urtica urens* Thousands of plants formed a dense colony in an unused corral at the south end of the corral complex. Others were scattered about the corral margins. A number of plants spilled down a south-facing, dry streambed at the south edge of the pack station as well. Other than the streambed individuals, *U. urens* appeared to be restricted to the pack station complex.

## Grasshopper Meadow

*Poa pratensis* Thousands of plants grew throughout Grasshopper Meadow, 1.5 kilometers southeast of Roaring River Ranger Station.

## **Grunnigan Ranch**

*Carya* sp. One tree was found at the edge of a field bordering Yucca Creek. This mature tree appeared to be a residual planting.

*Diospyros* sp. A dense, 200-square-meter stand of trees up to 15 meters tall was observed along the eastern edge of a clearing within the Grunnigan Ranch site. The trees were apparently reproducing vegetatively. No additional populations were seen within the survey site nor in the adjacent Yucca creek.

*Nerium oleander* This lone large shrub grew between Yucca Creek and the Old Hidden Springs Road near an old house foundation in a south facing, anthropogenic clearing. No other individuals were observed in the area. This is the first collection for Sequoia-Kings Canyon National Parks.

*Olea europaea* Five mature trees bearing fruit were found approximately 200 m from Yucca creek along the Old Hidden Springs road. There are no apparent young saplings in the vicinity. There are, however, shoots growing from bases of the boles. First collection for Sequoia-Kings Canyon National Parks.

*Punica granatum* One individual, almost surely a residual planting, was found. It was in a partly shaded grassy area, 100 meters east of where the Old Hidden Springs Road crosses Yucca Creek.

*Pyracantha angustifolia* Several mature shrubs were observed in a 10-square-meter thicket along the western edge of a large clearing in the former Grunnigan Ranch site. No other populations were observed within the ranch area. This apparently was a residual planting.

*Rubus discolor* There was a dense patch in an open field at the former site of the Grunnigan Ranch. The patch was oval in shape and was approximately 35 meters long by 24 meters wide. *R. discolor* was also abundant in nearby Yucca Creek between Grunnigan Ranch and the North Fork of the Kaweah.

## **Halstead Meadow**

*Poa pratensis* Thousands of individuals were observed 10 meters south of the Generals Highway on the west side of the meadow. The plants were growing in an open, wet meadow in well developed, moist soil. Scattered individuals were seen throughout the meadow, especially along the meadow edge.

*Tragopogon dubius* Five individuals were seen growing where the Generals Highway bisects the meadow in a sandy berm. All five plants were pulled up.

## **High Sierra Trail**

*Bromus tectorum* Collected along trail approximately 1 km east of Bearpaw Ranger Station on the trail towards Kaweah Gap. There are scattered patches of *Bromus tectorum* all along the trail in this area. *B. tectorum* can be seen at least 100 m below the trail here. It would appear to be not dependent on the trail.

*Poa pratensis* Collected alongside the trail growing with *Bromus tectorum* and *Vulpia myuros* ssp. *hirsuta*.

## **Hockett Meadow and Pasture**

*Phleum pratense* Fewer than 100 individuals were observed alongside the trail to Evelyn Lake approximately 0.5 km from Hockett Meadow. The population was growing in a wet lodgepole forest with a dense herbaceous understory. A few small populations of this plant species were seen in and about Hockett Meadow growing in disturbed, trailside areas as well as in relatively undisturbed, streamside areas. *Phleum alpinum*, the native timothy, was much more abundant than *P. pratense*.

*Poa pratensis* Thousands of individuals were seen growing 150 meters southeast of the Hockett Meadow Ranger Station along the horse pasture fence.

### **Hospital Rock**

*Carduus pycnocephalus* One plant grew adjacent to the parking lot in a crack between a cement curb and some compacted soil.

*Lolium perenne* Hundreds of plants grew in scattered clumps in grassy areas and asphalt cracks throughout the picnic area

*Poa pratensis* Hundreds of plants were found beneath a mature *Umbellularia californica*.

*Polypogon monspeliensis* Fewer than ten plants grew alongside the Generals Highway in a moist, disturbed ditch at the north edge of the survey area.

### **JR Meadow**

*Poa pratensis* Thousands of plants grew throughout J. R. Meadow, 300 meters northwest of the Roaring River Ranger Station. This meadow sees annual grazing.

### **Kern Ranger Station**

*Poa pratensis* Collected in the Kern Ranger Station Stock Pasture

### **Lewis Creek Trail**

*Bromus tectorum* Though not as abundant as on the floor of the Cedar Grove Valley, *B. tectorum* was still common in open patches in several places along the trail. The thousands of plants we saw were not restricted to areas of human disturbance.

*Poa pratensis* Dozens of plants grew at a stream crossing several kilometers north of the trailhead. These plants grew in moderately disturbed, partly shaded, saturated, stream bank soil.

### **Lodgepole Campground**

*Bromus tectorum* Fewer than 1000 individuals were seen growing in the campground on the north side of the river in dry, open, granitic soils.

*Poa bulbosa* Thousands of individuals were seen within the campground 50 meters south of the Marble Fork. They were in disturbed, sandy, well drained soil with a sparse herbaceous understory.

*Poa pratensis* A population of fewer than one hundred individuals was observed within the campground on the south side of the river in a moist, partly disturbed area.

### **Lodgepole Developed Area**

*Cirsium vulgare* A population of fewer than 10 individuals was seen growing approximately 20 m west of the Lodgepole Visitor Center adjacent to a concrete walkway. The population was in moderately disturbed, well drained granitic soil.

*Dactylis glomerata* Two individuals were seen 50 meters south of the Visitor Center adjacent to a dirt footpath in moderately disturbed, open, granitic soil. Another individual was seen on the north side of the river.

*Digitalis purpurea* Two individuals were observed on the north side of the river adjacent to an asphalt road that leads to the Lodgepole Fire House. They grew in moderately disturbed, well-drained, granitic soils.

*Iris* sp. A single vegetative *Iris* species grew on the north side of the river on a steep slope adjacent to a large asphalt parking lot. Another individual was observed growing adjacent to a deserted government residence. These apparently were escaped cultivars.

*Phalaris arundinacea* Forty meters west of the Lodgepole Visitor Center and adjacent to an asphalt parking lot in a nearly flat, open disturbed site with well-drained, granitic soil.

*Verbascum thapsus* A population of three individuals was observed 20 meters south of the Lodgepole Fire Station adjacent to an asphalt parking lot. All three individuals were pulled up.

*Verbascum virgatum* A single population of fewer than 10 individuals was observed on the north side of the river adjacent to an asphalt road that leads to the Lodgepole Fire House. The population was in moderately disturbed, well-drained, granitic soil. No other populations were seen throughout the survey area.

### **Marble Fork of the Kaweah River**

*Rubus discolor* A distinct patch of fewer than 100 individuals was caught growing in a three meter by three meter area on the banks of the Marble Fork of the Kaweah River near the Generals Highway bridge. The population was growing in partial shade.

### **Marvin Pass Trail**

*Cirsium vulgare* Hundreds of these plants grew in a small meadow three kilometers northwest of the Roaring River Ranger Station. They did not appear to be dependant on anthropogenic disturbance.

*Holcus lanatus* Dozens of plants grew in the center of the Roaring River Trail three kilometers northwest of the Roaring River Ranger Station. They grew in a moderately sloping, southeast-facing, trampled, sunny seep.

*Poa pratensis* Thousands of plants grew in Comanche Meadow, roughly 6 kilometers west-southwest of the confluence of Sugarloaf Creek and Roaring River.

### **Middle Fork Flume**

*Bromus tectorum* This plant was collected in a flat, open area directly adjacent to the concrete flume wall. It is abundant throughout the survey area. This is the lowest elevation that this plant has been observed this year.

### **Middle Fork of the Kaweah River**

*Echinochloa crus-galli* Fewer than ten plants grew along the moist, mossy, shaded, moderately sloping, north-facing east bank of the Kaweah River, 800 meters upstream of the park boundary.

*Ficus carica* A single individual, approximately one meter tall, was seen on the south side of the river just below the Research Center in a rocky area. We attempted to pull the plant up but some of the roots remained.

*Morus alba* A single individual approximately two meters tall was seen in a shaded, dry, cobbled swale on the north side of the river. No other individuals were seen in the survey area.

*Polypogon monspeliensis* This population was growing in a moist, flat sandbar 100 meters upstream of where the trail from Ash Mountain Headquarters leads to the river. The population is along a natural diversion from the main water course on the W side of the river. There are frequent populations of this species throughout the corridor in perennially moist sites. A large, dense colony of over 10,000 individuals was observed on the south side of the river approximately 1 km E of Ash Mountain Headquarters. The population formed a dense colony in a area with well developed soil and very dense herbs with standing water in the center. Much of this population was growing directly out of standing water.

*Pyracantha angustifolia* A few scattered mature shrubs were observed growing in a flat cobbled, floodplain 150 meters upstream of where the trail from Ash Mountain Headquarters leads to the river. There are individuals on both sides of the river.

*Spartium junceum* Hundreds of plants were growing on the rocky floodplain on the west bank of the river. It appeared that most of the above-ground plant material was scoured off during winter flood events, but shoots were resprouting vigorously. This population is periodically cut back by park personnel.

*Tamarix* sp. A single vegetative seedling was found in a moist sand bar during the fall survey of the river.

#### **Milk Ranch Lookout**

*Bromus tectorum* Over 1000 individuals were observed scattered throughout the open, disturbed, dirt parking area/clearing 15 m south of the Milk Ranch Fire Tower.

*Poa Bulbosa* Over 1000 individuals were observed scattered throughout the open, disturbed, dirt parking area/clearing 15 m south of the Milk Ranch Fire Tower.

#### **Milk Ranch Road**

*Cirsium vulgare* Fewer than 1000 individuals of this plant were seen outside of the park boundary along the road to Milk Ranch scattered throughout a clearing/meadow along the west side of the road.

*Medicago sativa* One plant was observed approximately 1 km south of Milk Ranch Lookout adjacent to the Milk Ranch road. It was growing in compact, well drained sandy soil within a moderately dense herbaceous layer. No other plants were observed nearby.

#### **Mineral King Pack Station**

*Poa pratensis* *Poa pratensis* was found throughout the pack station complex along roadsides in less disturbed areas. It is present further from the complex further than other exotics. This plant was collected from a small colony in an undisturbed area of the meadow below the pack station.

*Trifolium repens* This species grew in moist, disturbed places throughout the survey area.

*Urtica urens* Scattered clumps were observed growing in disturbed soil directly next to the fence posts of the corral. No other vegetation was growing nearby.

*Verbascum thapsus* This plant was collected from the roadside near the pack station.

#### **Moraine Campground**

*Bromus tectorum* Thousands of these plants grew throughout Cedar Grove in open, sandy places. They were not restricted to human disturbance.



## Muir Grove

*Cirsium vulgare* Fewer than ten individuals were observed growing beneath the big trees of Muir Grove in loose duff.

## North Fork of the Kaweah River

*Echinochloa crus-galli* A single population of fewer than 10 individuals was observed along the bank of the river. No other individuals were seen within the survey area.

*Piptatherum miliaceum* A single population of this plant was observed in the North Fork river corridor growing out of metasedimentary rock cracks.

*Polypogon monspeliensis* Fewer than 100 vegetative plants were seen scattered in dry rock cracks adjacent to the river.

*Mentha pulegium* Dozens of plants were found in partly shaded, rocky and sandy places in and adjacent to the floodplain of the Kaweah River along the lower end of the survey area. First collection for Sequoia-Kings Canyon National Parks.

*Mentha spicata* A few small populations were found in well-shaded floodplains at the middle and upper reaches of the survey area. First collection for Sequoia-Kings Canyon National Parks.

*Rubus discolor* Six populations, each with a diameter of two meters, were observed in the survey area.

*Tamarix* sp. This vegetative plant appears to be a species of Tamarix, salt cedar. Two seedlings were seen in the North Fork, in a low, moist, sunny sand bar, at the park boundary. Seedlings were also seen in low moist sand bars in the Middle Fork of the Kaweah River, and in one of its tributaries, Sycamore Creek. No seedlings were over 15 centimeters tall, and all appeared to have established this season. It appeared very likely that all the seedlings sighted in the surveys were destined to be washed away in winter runoff, as all were in low, moist, recently deposited sandbars. This is the first collection for Sequoia-Kings Canyon National Parks.

*Verbascum thapsus* Two vegetative rosettes were seen in a dry, sandy, open section of the riverbank approximately 150 m upstream of the confluence with Yucca creek.

## North Fork Parking Lot

*Carduus pycnocephalus* Fewer than 100 vegetative individuals were observed scattered along the lower parking lot margins in shaded, moderately disturbed sites.

## Old Hidden Springs Road

*Cirsium vulgare* Fewer than ten individuals were observed growing where a perennial stream crosses the road within a shaded, gently sloping, S-facing hillside. The site was less than one kilometer from Hidden Springs. No plants of this species were seen any closer to Hidden Springs.

*Silybum marianum* This straggling rosette was growing out of cow manure in the shade of planted *Olea europaea* L. trees. Numerous flowering individuals of this species were subsequently found in nearby Yucca Creek.

*Vicia benghalensis* One large colony was found nine kilometers up Old Hidden Springs Road in Blue Oak Woodland. In this area the road cuts across an open, grassy, moderately sloping, north-facing hillside. This colony measured 20x40 meters and constituted approximately 90% of the groundcover. The colony was centered on the roadbed, but also crept into adjacent undisturbed grassland. This is the first collection for Sequoia-Kings Canyon National Parks.

## Oriole Lake Airstrip

*Vulpia bromoides*                      Thousands of these plants were observed scattered throughout the western half of the Oriole Lake Airstrip growing in well-drained, granitic soils.

## Oriole Lake Meadow

*Bromus tectorum*                      Thousands of individuals were throughout a moderately disturbed wet montane meadow 200 m north of the Oriole Lake Airstrip. The meadow had signs of cattle grazing this year.

*Trifolium repens*                      Fewer than 100 individuals grew in small colonies throughout a moderately disturbed wet montane meadow 200 meters north of the Oriole Lake Airstrip. The meadow had signs of recent cattle grazing. Thousands of individuals were observed along the north edge of the Oriole Lake Airstrip and along the dirt road 25 meters north of the airstrip. Fewer than 100 individuals in small colonies were observed in a moderately disturbed wet montane meadow 200 m north of the Oriole Lake Airstrip. The meadow had signs of cattle grazing this year.

*Verbascum thapsus*                      Fewer than 1000 individuals were scattered throughout a moderately disturbed wet montane meadow 200 m north of the Oriole Lake Airstrip. The meadow had signs of cattle grazing this year.

## Oriole Lake Road

*Bromus tectorum*                      Thousands of individuals were observed 25 m north of the Oriole Lake Airstrip adjacent to a maintained dirt road in a moist, open, partly disturbed area.

*Poa pratensis*                      Fewer than 1000 individuals were observed 25 m north of the Oriole Lake Airstrip adjacent to a maintained dirt road in a moist, open, partly disturbed area.

*Trifolium repens*                      Thousands of individuals were observed along the north edge of the Oriole Lake Airstrip and along the dirt road 25 meters north of the airstrip

*Verbascum thapsus*                      Fewer than 1000 individuals were observed 25 m north of the Oriole Lake Airstrip adjacent to a maintained dirt road in a moist, open, partly disturbed area.

## Potwisha Campground

*Carduus pycnocephalus*                      A single colony of several hundred individuals was sighted along the east edge of the campground. The colony was approximately 6 m by 2 m. No other individuals were observed throughout the survey area.

*Convolvulus arvensis*                      One plant grew along the north side of the entrance to Potwisha Campground among annual grasses in partly shaded, sandy soil. First collection for Sequoia-Kings Canyon National Parks.

*Marrubium vulgare*                      Thousands of these plants grew throughout the campground in open to partly shaded areas of moderate disturbance. In some places, dense colonies of hundreds of individuals excluded all other vegetation. Park maintenance workers report a marked increase in population size in recent years.

*Poa bulbosa*                      Thousands of these plants were observed scattered throughout the entire campground in both disturbed and undisturbed sites.

*Poa pratensis*                      A population of fewer than one hundred individuals were observed at the north-east edge of the campground. They were growing amidst annual grasses on a moderately steep hillside in the shade of *Quercus wislizenii* var. *wislizenii*. No other populations were observed within the survey area.

*Ranunculus parviflorus*                      Thousands of these plants were seen in dense clusters in shaded areas throughout the campground.

*Rubus discolor*                      One population consisting of fewer than ten individuals was recorded. It was in the northeast end of the campground growing in the middle of a very dense colony of *Marrubium vulgare* near campsite 29 in partial shade. There also were dozens of individuals growing in a three-square-meter area on the partly shaded west bank of the Kaweah River near the Marble Fork bridge.

*Urtica urens*                      Hundreds of individuals were seen throughout the campground in scattered clumps in loose, recently disturbed mineral soil. No individuals were observed in undisturbed areas of the campground.

*Vinca major*                      A single colony was observed in a nearly flat area along the western edge of the campground at the base of an interior live oak tree. The colony completely covered a 50-square-meter area. No other populations were observed in the campground. This appeared to be a residual planting.

*Vulpia bromoides*                      A large colony of greater than 1000 individuals was seen at the end of the dirt road adjacent to the flume on the north side of the campground in sandy, compacted, open, moderately disturbed soil. No other populations were observed throughout the campground.

### **Rae Lakes Loop Trail**

*Bromus tectorum*                      Hundreds of plants grew 20 meters north of where the Mist Falls Trail crosses Bubb's Creek. They grew in patches on exposed, sandy soil and did not appear to be restricted to human disturbance. We saw hundreds of individuals growing in open patches along the Mist Falls Trail, they did not appear to be restricted to human disturbance. *B. tectorum* seemed less abundant here than farther down the valley nearer the developed areas. Dozens of plants grew along the trail in sandy soil among granite boulders. Thousands of plants grew along the Mist Falls Trail in open, sandy places. Hundreds of plants grew in a shaded, gently sloping, wooded area near the lower Paradise Valley Campground. Hundreds of plants grew along the Paradise Valley Trail in an exposed, recently burned area five kilometers north of Mist Falls. Thousands of plants grew on an exposed, sandy slope along the Bubb's Creek Trail three kilometers west of the Charlotte Creek Crossing. These plants were common along the switchbacks from the Sphinx Creek Crossing to the valley floor. SEE MAP we saw thousands of individuals along the Bubb's Creek Trail in sandy soil, they did not appear to be restricted to human disturbance. Hundreds of plants grew along the Bubb's Creek Trail in a partly shaded sandy area one kilometer north of Charlotte Creek. This was the highest population we saw on the Bubb's Creek Trail.

*Cirsium vulgare*                      We saw dozens of plants at stream crossings, the plants seemed concentrated at areas of human disturbance. Hundreds of plants grew in a moist, shaded area alongside the Mist Falls Trail, three kilometers east of Road's End. Dozens of plants grew in a dry, sandy streambed along the Bubb's Creek Trail 100 meters east of its junction with the Mist Falls Trail. One vegetative individual grew on the partly shaded edge of a wet meadow. Hundreds of plants grew alongside the Bubb's Creek Trail on a steep, south-facing, sandy slope three kilometers west of the Charlotte Creek Crossing. Numerous plants grew in an adjacent stream. Hundreds of plants grew in a stream near the Bubb's Creek Trail three kilometers west of Charlotte Creek. They were not restricted to the trailside.

*Echinochloa crus-galli*                      Single plant was observed along the trail margin in a nearly flat site with sandy, well-drained, granitic soil.

*Poa pratensis*                      Hundreds of plants grew along the Rae Lakes Loop Trail in a moist seep adjacent to a small, unnamed meadow above Vidette Meadow. Hundreds of plants grew in the heavily grazed stock camp at Junction Meadow. Dozens of plants grew in the open drier sites within Castle Domes Meadow. The meadow had signs of being grazed by stock this year. Thousands of plants grew in a grazed meadow near the Rae Lakes Trail in the vicinity of Woods Creek. Hundreds of these plants grew on stream banks along the first kilometer of the Mist Falls Trail. They did not appear restricted to areas of human disturbance. Hundreds of plants grew in a stream near the Bubb's Creek Trail three kilometers

west of Charlotte Creek. They were not restricted to the trailside. Hundreds of plants grew adjacent to the trail on exposed, moist soil.

*Verbascum thapsus* We saw dozens of plants at stream crossings, the plants seemed concentrated at areas of human disturbance.

### **Rattlesnake Creek Trail**

*Poa pratensis* This plant was collected at a stream crossing of a tributary of Rattlesnake Creek. This was on the trail between Franklin Pass and the Kern Canyon.

### **Red Fir Maintenance Area**

*Bromus tectorum* Thousands of individuals were observed growing throughout the survey area in open, well drained, sandy, granitic soils.

*Cirsium vulgare* Fewer than 100 individuals were observed scattered throughout the spray field adjacent to a moderately used dirt road leading through the middle of the site. Several rosettes were observed outside of the radius of the sprinklers. Fewer than 1000 individuals were seen scattered throughout the survey area. A large population was observed in a small drainage east of the maintenance building.

*Poa pratensis* Fewer than 10 individuals were seen growing between the two maintenance buildings adjacent to an asphalt parking lot in nearly flat, disturbed granitic soil.

*Verbascum virgatum* Fewer than one hundred individuals were observed scattered along the west side of the lower maintenance building in small moist ditch. Other individuals were scattered throughout the survey area in open sandy soils adjacent to asphalt roadways.

### **Redwood Canyon Trail**

*Cirsium vulgare* Fewer than ten plants grew in shaded, well developed, moist soil alongside the Redwood Creek Trail 50 meters northeast of the junction with the Hart Loop Trail. One plant grew in an exposed, well-vegetated sand bar in Redwood Creek.

*Trifolium repens* Dozens of plants grew in moist, moderately shaded, well-developed soil near the Redwood Creek Trail just below Redwood Saddle.

### **Redwood Creek**

*Bromus tectorum* Collected in a disturbed area near the Redwood Creek Parking area on the Mineral King Road.

*Poa pratensis* Collected in a disturbed area near the Redwood Creek Parking area on the Mineral King Road.

*Rubus discolor* A large, dense population was observed within the creek bed from the roadside to about 50 meters upstream. Two other patches were observed downstream of the Mineral King Road. One patch was directly below the road and covered an area of approximately 8m by 12m. The other patch was further downstream and was only 1m by 2m. Both populations were growing directly in the creek.

*Trifolium repens* Several colonies were scattered in moist, disturbed areas.

## **Scaffold Meadow**

*Phleum pratense*                      Thousands of plants grew throughout scaffold Meadow, 300 meters north of Roaring River Ranger Station. This meadow receives heavy annual grazing from pack animals. The population often dominated the herb layer in several areas within the meadow. *Phleum pratense* was much more common than its native sympatric brother, *P. alpinum*.

*Poa pratensis*                      Thousands of plants grew throughout Scaffold Meadow, 300 meters north of Roaring River Ranger Station. The plants were observed in both wet and dry sites in this meadow. Scaffold Meadow receives heavy annual grazing from pack animals.

## **Sentinel Campground**

*Ranunculus testiculatus*                      A single dense population of greater than 1000 individuals was observed in a moderately disturbed area on the east edge of the campground in well-drained, granitic soil. This is the only population of this species that we observed in 1998. First collection for Sequoia-Kings Canyon National Parks.

## **Sequoia Lake Trail**

*Cirsium vulgare*                      A single individual was observed adjacent to a small, flowing drainage in moist, well-developed soil. We pulled the plant up.

*Poa pratensis*                      Dozens of plants grew in a steep, rocky streambed along the Sequoia Lakes Trail.

## **Sheep Creek Campground**

*Bromus tectorum*                      We saw thousands plants in sunny places about the campground. This species is abundant in the Cedar Grove Valley and does not appear to be dependant on human disturbance.

*Poa bulbosa*                      We found one population in a dry, partly shaded, roadside ditch near campsite #13.

*Poa compressa*                      A colony of fewer than 100 individuals was observed growing near the east edge of the campground in a moist, sandy swale, adjacent to a paved campground road. No other populations were observed within the survey area.

*Poa pratensis*                      We saw two populations in the campground, neither contained more than 100 plants. One grew at the base of a water spigot and the other grew in a dry, roadside ditch.

## **Sheppard Saddle Road**

*Polypogon monspeliensis*                      100 meters west of Ash Mountain Shooting Range in a roadside ditch. The population is emergent out of 5 cm of standing water.

## **South Fork Campground**

*Carduus pycnocephalus*                      A few individuals were found in the middle part of the campground in a partly shaded, moderately sloping, northwest-facing, grassy area.

*Cirsium vulgare*                      Dozens of individuals were found in the middle part of the campground near campsite #5. They were growing in a partly shaded, moderately sloping, northwest-facing, grassy area. Last years flowering stalks were visible there, too. *C. vulgare* was not sighted elsewhere in the campground.

*Tragopogon dubius* Eleven plants were found (and killed) in a partly shaded grassy area with a dry streambed running through it. They were in the western part of the campground. No other populations were found.

*Vulpia bromoides* Hundreds of these plants were scattered throughout the campground in both moderately disturbed and undisturbed, grassy areas.

### **Sugar Bowl Trail**

*Bromus tectorum* Hundreds of plants grew among giant sequoia seedlings in well drained soil on an exposed, moderately sloping, east-facing, recently burned clearing.

*Cirsium vulgare* One plant grew among giant sequoia seedlings in well drained soil on an exposed, moderately sloping, east-facing, recently burned clearing.

### **Sugarloaf Meadow**

*Poa pratensis* Thousands of plants grew around the meadow margin. This meadow sees heavy annual stock use.

### **Sunset Campground**

*Bromus tectorum* Fewer than 100 of these individuals were observed in dry, developed soil 5 m from the northwest edge of Eli's Paradise Meadow. This is the former site of Sunset Campground, which closed in the late 1960's.

*Cirsium vulgare* Thousands of these individuals were seen growing throughout Eli's Paradise Meadow and radiating into the adjacent big tree forest in both disturbed and undisturbed sites in partial shade with well developed soils. This is the former site of Sunset Campground, which closed in the late 1960's.

*Dactylis glomerata* Fewer than 1000 individuals were observed scattered along the margins of Eli's Paradise Meadow in partly shaded, moist soil with dense herbaceous understory. This is the former site of Sunset Campground, which closed in the late 1960's.

*Digitalis purpurea* Many hundreds of these plants grew in Eli's Paradise, a montane meadow about 500 meters northwest of Round Meadow. They were especially common along the broad southeast margin of the meadow, where there was little standing water. This plant was documented in disturbed areas of both Lodgepole Pine and Big Tree Forest community types in 1997 surveys. This is the former site of Sunset Campground, which closed in the late 1960's.

*Poa pratensis* Fewer than 1000 individuals were observed growing in small populations along the margins of Eli's Paradise Meadow in partly shaded, moist soil with dense herbaceous understory. This is the former site of Sunset Campground, which closed in the late 1960's.

*Verbascum thapsus* Fewer than 100 individuals were seen growing where Eli's Paradise Meadow radiates into the adjacent Big Tree Forest. The individuals were growing in well developed soils with long-leaf pine litter in partial shade. This is the former site of Sunset Campground, which closed in the late 1960's.

### **Swale Administrative Campground**

*Centaurea solstitialis* Two plants observed. Both were collected.

*Cirsium vulgare* Collected at Swale Campground along the edges of a moist roadbed. The density of plants along the roadside averaged approximately 2-3 plants per square meter. There is a patch in an adjacent meadow that is roughly 2 m by 5 m.

*Verbascum thapsus*  
campground.

Hundreds of plants grew in moist, disturbed places about the

### **Sycamore Creek**

*Arundo donax* An early season survey revealed a single population approximately 50 meters upstream of Highway 198 growing from a flat, wet sand bar directly in the creek bed. On a return visit in August, three small colonies were observed in the same area. No other populations were encountered within the Sycamore Creek survey area. There was evidence that somebody had been actively eradicating this population; large piles of uprooted shoots were scattered throughout the area.

*Carduus pycnocephalus* Thousands of these plants grew near the crossing of Shepherd Saddle Road on the stream bank and in the neighboring grassland, often choking out all other vegetation and attaining enormous size (up to 1.5m). Plants growing near the stream were bigger than plants in the adjacent grassland. Downstream of the crossing there were scattered plants in sunny areas but no colonies attained the size of the first.

*Echinochloa crus-galli* This plant is very likely a species of *Echinochloa*, a late season, non-indigenous, annual grass. Fewer than ten plants were seen in Sycamore Creek growing in moist, well vegetated soil banks.

*Marrubium vulgare* Fewer than 10 seedlings were observed on loose, sandy, well drained soils. Several mature plants were observed growing 10 meters west of the stream corridor along the Shepherd Saddle Road.

*Melilotus indica* One small population of fewer than 100 individuals was observed on moist sand in deep shade. No other individuals were seen in the survey area.

*Polypogon monspeliensis* Thousands of individuals were observed in small colonies throughout the survey area

*Pyracantha angustifolia* One plant was found growing in the middle of the stream in a shady spot at the base of a mature *Platanus occidentalis*. This plant grew about 50 meters upstream of Buckeye Drive. This is the first collection for Sequoia-Kings Canyon National Parks.

*Tamarix* sp. Two seedlings were observed in a sand bar in the middle of the stream in deep shade. The plants were less than 10 centimeters tall and appeared to be first-year seedlings. Due to the immaturity of the seedlings, it was impossible to determine the species of *Tamarix* that was seen. Other sightings of *Tamarix* this year have occurred during surveys in the Middle and North Forks of the Kaweah River. See collection ASP #4350 PW for a voucher specimen from the North Fork.

### **Trail for All People**

*Dactylis glomerata* Thousands of individuals were seen scattered throughout the meadow edge, primarily on the west and north edges along the "Trail for All People". The plants radiate into the adjacent Big Tree Forest for several meters. Other populations of this species were observed at Eli's Paradise and along the asphalt road to Lower Kaweah on the west side of the Giant Forest Lodge.

*Phleum pratense* Thousands of these plants grew around the margins of Round Meadow in partly shaded areas devoid of standing water.

### **Traugers Creek**

*Lathyrus latifolius* Thousands of individuals in large, dense colonies were observed at the junction of the Mineral King road and Traugers Creek. A large colony is directly along the Mineral King Road and extends approximately fifty meters upstream from the road.

*Malus sylvestris* A mature, fruiting tree with several smaller trees nearby grew 20 meters upstream of the Mineral King Road. There were no other trees observed downstream of this population.

*Poa pratensis* Fewer than 100 individuals were seen scattered throughout Trauger's creek in moist, shaded areas.

### **Williams Meadow**

*Poa pratensis* Tens of thousands of plants grew around the margins of this very expansive montane meadow.

### **Wolverton Pack Station**

*Tragopogon dubius* A single individual was found along the southern edge of the pack station complex in a mildly disturbed area. No other individuals were seen within the complex.

### **Wolverton Snow Play Area**

*Poa pratensis* Thousands of individuals growing in small populations were seen throughout the meadow in flat, wet, open areas with dense herbaceous layers and well developed, poorly drained soils.

### **Wuksachi**

*Bromus tectorum* Thousands of individuals were growing in large colonies throughout the Wuksachi Complex in open, undisturbed and moderately disturbed sites.

*Cirsium vulgare* A population of 12 individuals was observed adjacent to the northeast corner of the Wuksachi Fire House in open, moderately disturbed, well-developed soils.

*Echinochloa crus-galli* A large population of greater than 1000 individuals was observed in a strip of loose disturbed, bare soil between an asphalt road and a concrete sidewalk. The strip of dirt had rice straw laid down upon it. The population was approximately 20 m by 2 m. There was very little other vegetation growing there. No other populations were observed elsewhere in the survey area.

*Melilotus alba* A single plant was seen growing 75 meters east of the Wuksachi Fire Station alongside an asphalt road.

*Tragopogon dubius* Fewer than 100 individuals were seen scattered throughout the complex in open, partly disturbed areas with little herbaceous under story.

*Verbascum thapsus* Three plants were seen on south side of the sewage treatment plant. Populations were observed scattered throughout the Wuksachi Complex.

*Verbascum virgatum* Populations of this plant species grew in dry, exposed, roadside areas. One population was near the sewage treatment facility and one was alongside the entrance road to Wuksachi proper. These populations, numbering a few dozen plants each, contained first-year rosettes as well as blooming individuals. Fewer than 100 plants were observed two hundred meters southwest of the Wuksachi Fire Station in a flat, open area adjacent to the parking lot. The population was in decomposed granite and mulch laid down a previous year. Another population of fewer than twenty individuals was seen adjacent to the road leading to Wuksachi approximately one hundred meters north of the Generals Highway.

### **Yucca Creek**

*Carduus pycnocephalus* Fewer than 100 individuals were observed in small colonies scattered throughout the riparian zone in open, dry sand bars and rock cracks.



*Ficus carica* This species has been noted in three different places in this area of Sequoia National Park. Two separate plants have been seen in the North Fork of the Kaweah River, upstream of Yucca Creek. The third and largest population grew in and along a lush, shady, rocky section of Yucca Creek about 100 meters upstream of the Kaweah River. There were a dozen or so individuals in this population, including one mature tree which had a trunk of 20 centimeters in diameter at 1.7 meters above the ground. The other members of this colony were but a few years old. Reproduction appeared to be of both sexual and vegetative nature. The entire colony occupied a space not bigger than 25 square meters. This is the first collection for Sequoia-Kings Canyon National Parks.

*Juglans californica* These vegetative plants were likely a species of walnut native to the Great Valley and to western parts of California. What appeared to be one mother plant and ten or fifteen offspring grew along the north bank of Yucca Creek, about 350 meters upstream of the Old Hidden Springs Road crossing. The "mother" plant grew alongside the Old Hidden Springs Trail (residual planting?). The slope below it dropped into Yucca Creek. The several naturalized plants, ranging from about one to ten years old, were scattered upstream and downstream of the mature plant on the partly shaded, well-vegetated stream bank. What appeared to be *Juglans regia* (the walnut of commerce, not native to California) also grew nearby. These species are known to hybridize.

*Juglans regia* Alongside the Old Hidden Springs Trail and about 350 meters upstream of the Old Hidden Springs Road crossing near a population of *Juglans californica* (see description above). Known to hybridize with *J. californica*.

*Poa pratensis* Fewer than 1000 individuals were observed growing in scattered populations in partly shaded areas.

*Polypogon interruptus* Fewer than ten of these plants were seen in Yucca Creek in shaded, moist, rocky, streamside areas. This is the first collection for Sequoia-Kings Canyon National Parks.

*Polypogon monspeliensis* Fewer than 100 individuals were seen scattered throughout the creek in open sand bars and rock cracks.

*Rubus discolor* Thousands of individuals growing in numerous large colonies were observed in shaded places throughout the survey area.

*Silybum marianum* Two populations of this plant were seen along Yucca Creek. One population was on an exposed, rocky, grassy flood plain, two kilometers upstream of the Kaweah River. The other population was on an exposed sandy bank \ flood plain a few hundred meters downstream of the first. Each population contained a few dozen individuals and both were on the north side of Yucca Creek. This is the first collection for Sequoia-Kings Canyon National Parks.

*Vitis vinifera* Frequent, dense patches of this plant are scattered throughout Yucca Creek. A native grape species, *Vitis californica* Benth. also occurs in the creek.

### **Zumwalt Meadow Trail**

*Bromus tectorum* We found fewer than 100 plants on the partly shaded, rocky, north bank of the Kings River 100 meters east of the trailhead parking lot.

*Cirsium vulgare* We found fewer than 100 plants on the partly shaded, sandy, north bank of the Kings River 120 meters east of the trailhead parking lot.

*Poa pratensis* We found fewer than 1000 plants on the partly shaded, sandy, north bank of the Kings River 120 meters east of the trailhead parking lot.

*Verbascum thapsus* We found fewer than 100 plants on the partly shaded, rocky, north bank of the Kings River 100 meters east of the trailhead parking lot.

Appendix D. Yosemite National Park exotic plant species of roadsides.

Road	Elevation	Exotic Species	Exotic Species	Elevation	Road
El Portal Road	3842	<i>Aira caryophyllea</i>	<i>Agrostis gigantea</i>	6040	Wawona Road 3
El Portal Road	3842	<i>Bromus diandrus</i>	<i>Agrostis gigantea</i>	6051	Wawona Road
El Portal Road	3842	<i>Bromus hordeaceus</i>	<i>Agrostis viridis</i>	3964	Wawona Road
El Portal Road	3842	<i>Bromus inermis</i>	<i>Agrostis viridis</i>	4661	Tioga Road
El Portal Road	3842	<i>Bromus tectorum</i>	<i>Agrostis viridis</i>	6040	Wawona Road 3
El Portal Road	3842	<i>Chenopodium album</i>	<i>Aira caryophyllea</i>	3842	El Portal Road
El Portal Road	3842	<i>Chenopodium botrys</i>	<i>Aira caryophyllea</i>	3964	Wawona Road
El Portal Road	3842	<i>Cynosurus echinatus</i>	<i>Aira caryophyllea</i>	4661	Tioga Road
El Portal Road	3842	<i>Galium parisiense</i>	<i>Aira caryophyllea</i>	5505	Hetch Hetchy Road
El Portal Road	3842	<i>Herniaria hirsuta</i>	<i>Aira caryophyllea</i>	6040	Wawona Road 3
El Portal Road	3842	<i>Hordeum murinum</i>	<i>Aira caryophyllea</i>	6051	Wawona Road
El Portal Road	3842	<i>Lactuca serriola</i>	<i>Amaranthus albus</i>	3959	Northside Drive
El Portal Road	3842	<i>Plantago lanceolata</i>	<i>Anthemis cotula</i>	5969	Yosemite West
El Portal Road	3842	<i>Poa bulbosa</i>	<i>Avena barbata</i>	3964	Wawona Road
El Portal Road	3842	<i>Poa pratensis</i>	<i>Avena barbata</i>	4946	Big Oak Flat Road
El Portal Road	3842	<i>Polygonum arenastrum</i>	<i>Avena barbata</i>	5505	Hetch Hetchy Road
El Portal Road	3842	<i>Trifolium hirtum</i>	<i>Avena fatua</i>	4661	Tioga Road
El Portal Road	3842	<i>Vulpia myuros</i>	<i>Avena fatua</i>	5272	Big Oak Flat Road
Southside Drive	3958	<i>Bromus arenarius</i>	<i>Bromus arenarius</i>	3958	Southside Drive
Southside Drive	3958	<i>Bromus diandrus</i>	<i>Bromus diandrus</i>	3842	El Portal Road
Southside Drive	3958	<i>Bromus hordeaceus</i>	<i>Bromus diandrus</i>	3958	Southside Drive
Southside Drive	3958	<i>Bromus tectorum</i>	<i>Bromus diandrus</i>	3959	Northside Drive
Southside Drive	3958	<i>Chamomilla suaveolens</i>	<i>Bromus diandrus</i>	3964	Wawona Road
Southside Drive	3958	<i>Chenopodium album</i>	<i>Bromus diandrus</i>	4661	Tioga Road
Southside Drive	3958	<i>Chenopodium botrys</i>	<i>Bromus diandrus</i>	4946	Big Oak Flat Road
Southside Drive	3958	<i>Cirsium vulgare</i>	<i>Bromus diandrus</i>	5143	Wawona Road 2
Southside Drive	3958	<i>Cynosurus echinatus</i>	<i>Bromus diandrus</i>	5272	Big Oak Flat Road
Southside Drive	3958	<i>Dactylis glomerata</i>	<i>Bromus hordeaceus</i>	3842	El Portal Road
Southside Drive	3958	<i>Galium parisiense</i>	<i>Bromus hordeaceus</i>	3958	Southside Drive
Southside Drive	3958	<i>Hordeum murinum</i>	<i>Bromus hordeaceus</i>	3959	Northside Drive
Southside Drive	3958	<i>Hypochaeris radicata</i>	<i>Bromus hordeaceus</i>	3964	Wawona Road
Southside Drive	3958	<i>Lactuca serriola</i>	<i>Bromus hordeaceus</i>	4661	Tioga Road
Southside Drive	3958	<i>Lolium perenne</i>	<i>Bromus hordeaceus</i>	4946	Big Oak Flat Road
Southside Drive	3958	<i>Plantago lanceolata</i>	<i>Bromus hordeaceus</i>	5272	Big Oak Flat Road
Southside Drive	3958	<i>Poa bulbosa</i>	<i>Bromus hordeaceus</i>	5505	Hetch Hetchy Road
Southside Drive	3958	<i>Poa pratensis</i>	<i>Bromus inermis</i>	3842	El Portal Road
Southside Drive	3958	<i>Polygonum arenastrum</i>	<i>Bromus inermis</i>	5143	Wawona Road 2
Southside Drive	3958	<i>Rumex acetosella</i>	<i>Bromus inermis</i>	5505	Hetch Hetchy Road
Southside Drive	3958	<i>Silene latifolia</i>	<i>Bromus inermis</i>	6040	Wawona Road 3
Southside Drive	3958	<i>Sisymbrium altissimum</i>	<i>Bromus inermis</i>	7981	Tioga Road
Southside Drive	3958	<i>Taraxacum officinale</i>	<i>Bromus secalinus</i>	3959	Northside Drive
Southside Drive	3958	<i>Tragopogon dubius</i>	<i>Bromus secalinus</i>	3964	Wawona Road
Southside Drive	3958	<i>Trifolium repens</i>	<i>Bromus sterilis</i>	3959	Northside Drive
Southside Drive	3958	<i>Verbascum thapsus</i>	<i>Bromus tectorum</i>	3842	El Portal Road
Northside Drive	3959	<i>Amaranthus albus</i>	<i>Bromus tectorum</i>	3958	Southside Drive
Northside Drive	3959	<i>Bromus diandrus</i>	<i>Bromus tectorum</i>	3959	Northside Drive
Northside Drive	3959	<i>Bromus hordeaceus</i>	<i>Bromus tectorum</i>	3964	Wawona Road
Northside Drive	3959	<i>Bromus secalinus</i>	<i>Bromus tectorum</i>	4661	Tioga Road
Northside Drive	3959	<i>Bromus sterilis</i>	<i>Bromus tectorum</i>	4946	Big Oak Flat Road
Northside Drive	3959	<i>Bromus tectorum</i>	<i>Bromus tectorum</i>	5143	Wawona Road 2
Northside Drive	3959	<i>Chamomilla suaveolens</i>	<i>Bromus tectorum</i>	5272	Big Oak Flat Road
Northside Drive	3959	<i>Chenopodium album</i>	<i>Bromus tectorum</i>	5505	Hetch Hetchy Road
Northside Drive	3959	<i>Chenopodium botrys</i>	<i>Bromus tectorum</i>	5902	Big Oak Flat Road
Northside Drive	3959	<i>Cynosurus echinatus</i>	<i>Bromus tectorum</i>	5969	Yosemite West
Northside Drive	3959	<i>Dactylis glomerata</i>	<i>Bromus tectorum</i>	6040	Wawona Road 3
Northside Drive	3959	<i>Herniaria hirsuta</i>	<i>Bromus tectorum</i>	6051	Wawona Road
Northside Drive	3959	<i>Hordeum murinum</i>	<i>Bromus tectorum</i>	8472	Tioga Road
Northside Drive	3959	<i>Hypericum perforatum</i>	<i>Centaurea solstitialis</i>	5143	Wawona Road 2
Northside Drive	3959	<i>Lactuca serriola</i>	<i>Cerastium glomeratum</i>	4946	Big Oak Flat Road

Road	Elevation	Exotic Species	Exotic Species	Elevation	Road
Northside Drive	3959	<i>Lolium perenne</i>	<i>Cerastium glomeratum</i>	5969	Yosemite West
Northside Drive	3959	<i>Plantago lanceolata</i>	<i>Chamomilla suaveolens</i>	3958	Southside Drive
Northside Drive	3959	<i>Poa annua</i>	<i>Chamomilla suaveolens</i>	3959	Northside Drive
Northside Drive	3959	<i>Poa bulbosa</i>	<i>Chamomilla suaveolens</i>	3964	Wawona Road
Northside Drive	3959	<i>Poa pratensis</i>	<i>Chenopodium album</i>	3842	El Portal Road
Northside Drive	3959	<i>Polygonum arenastrum</i>	<i>Chenopodium album</i>	3958	Southside Drive
Northside Drive	3959	<i>Polygonum convolvulus</i>	<i>Chenopodium album</i>	3959	Northside Drive
Northside Drive	3959	<i>Rumex acetosella</i>	<i>Chenopodium album</i>	4661	Tioga Road
Northside Drive	3959	<i>Rumex crispus</i>	<i>Chenopodium album</i>	5143	Wawona Road 2
Northside Drive	3959	<i>Sisymbrium altissimum</i>	<i>Chenopodium album</i>	5272	Big Oak Flat Road
Northside Drive	3959	<i>Sonchus asper</i>	<i>Chenopodium album</i>	5969	Yosemite West
Northside Drive	3959	<i>Spergularia rubra</i>	<i>Chenopodium album</i>	6051	Wawona Road
Northside Drive	3959	<i>Taraxacum officinale</i>	<i>Chenopodium botrys</i>	3842	El Portal Road
Northside Drive	3959	<i>Tragopogon dubius</i>	<i>Chenopodium botrys</i>	3958	Southside Drive
Northside Drive	3959	<i>Trifolium repens</i>	<i>Chenopodium botrys</i>	3959	Northside Drive
Northside Drive	3959	<i>Vulpia myuros</i>	<i>Chenopodium botrys</i>	4661	Tioga Road
Wawona Road	3964	<i>Agrostis viridis</i>	<i>Chenopodium botrys</i>	5143	Wawona Road 2
Wawona Road	3964	<i>Aira caryophyllaea</i>	<i>Chenopodium botrys</i>	5272	Big Oak Flat Road
Wawona Road	3964	<i>Avena barbata</i>	<i>Chenopodium botrys</i>	5969	Yosemite West
Wawona Road	3964	<i>Bromus diandrus</i>	<i>Chenopodium botrys</i>	6051	Wawona Road
Wawona Road	3964	<i>Bromus hordeaceus</i>	<i>Cirsium vulgare</i>	3958	Southside Drive
Wawona Road	3964	<i>Bromus secalinus</i>	<i>Cirsium vulgare</i>	5143	Wawona Road 2
Wawona Road	3964	<i>Bromus tectorum</i>	<i>Cirsium vulgare</i>	5902	Big Oak Flat Road
Wawona Road	3964	<i>Chamomilla suaveolens</i>	<i>Cirsium vulgare</i>	5969	Yosemite West
Wawona Road	3964	<i>Cynosurus echinatus</i>	<i>Cirsium vulgare</i>	6040	Wawona Road 3
Wawona Road	3964	<i>Holcus lanatus</i>	<i>Cirsium vulgare</i>	6051	Wawona Road
Wawona Road	3964	<i>Hypericum perforatum</i>	<i>Cirsium vulgare</i>	6254	Tioga Road
Wawona Road	3964	<i>Lactuca serriola</i>	<i>Cirsium vulgare</i>	6440	Glacier Point Road
Wawona Road	3964	<i>Plantago lanceolata</i>	<i>Cynosurus echinatus</i>	3842	El Portal Road
Wawona Road	3964	<i>Poa bulbosa</i>	<i>Cynosurus echinatus</i>	3958	Southside Drive
Wawona Road	3964	<i>Poa pratensis</i>	<i>Cynosurus echinatus</i>	3959	Northside Drive
Wawona Road	3964	<i>Polygonum arenastrum</i>	<i>Cynosurus echinatus</i>	3964	Wawona Road
Wawona Road	3964	<i>Rumex acetosella</i>	<i>Cynosurus echinatus</i>	4661	Tioga Road
Wawona Road	3964	<i>Sonchus asper</i>	<i>Cynosurus echinatus</i>	4946	Big Oak Flat Road
Wawona Road	3964	<i>Spergularia rubra</i>	<i>Cynosurus echinatus</i>	5272	Big Oak Flat Road
Wawona Road	3964	<i>Vulpia myuros</i>	<i>Dactylis glomerata</i>	3958	Southside Drive
Tioga Road	4661	<i>Agrostis viridis</i>	<i>Dactylis glomerata</i>	3959	Northside Drive
Tioga Road	4661	<i>Aira caryophyllaea</i>	<i>Dactylis glomerata</i>	4946	Big Oak Flat Road
Tioga Road	4661	<i>Avena fatua</i>	<i>Dactylis glomerata</i>	6254	Tioga Road
Tioga Road	4661	<i>Bromus diandrus</i>	<i>Erodium cicutarium</i>	4946	Big Oak Flat Road
Tioga Road	4661	<i>Bromus hordeaceus</i>	<i>Galium parisiense</i>	3842	El Portal Road
Tioga Road	4661	<i>Bromus tectorum</i>	<i>Galium parisiense</i>	3958	Southside Drive
Tioga Road	4661	<i>Chenopodium album</i>	<i>Herniaria hirsuta</i>	3842	El Portal Road
Tioga Road	4661	<i>Chenopodium botrys</i>	<i>Herniaria hirsuta</i>	3959	Northside Drive
Tioga Road	4661	<i>Cynosurus echinatus</i>	<i>Herniaria hirsuta</i>	5272	Big Oak Flat Road
Tioga Road	4661	<i>Holcus lanatus</i>	<i>Herniaria hirsuta</i>	5902	Big Oak Flat Road
Tioga Road	4661	<i>Hypericum perforatum</i>	<i>Herniaria hirsuta</i>	8472	Tioga Road
Tioga Road	4661	<i>Lactuca serriola</i>	<i>Holcus lanatus</i>	3964	Wawona Road
Tioga Road	4661	<i>Phleum pratense</i>	<i>Holcus lanatus</i>	4661	Tioga Road
Tioga Road	4661	<i>Poa bulbosa</i>	<i>Holcus lanatus</i>	5272	Big Oak Flat Road
Tioga Road	4661	<i>Polygonum arenastrum</i>	<i>Holcus lanatus</i>	6051	Wawona Road
Tioga Road	4661	<i>Sonchus oleraceus</i>	<i>Hordeum murinum</i>	3842	El Portal Road
Tioga Road	4661	<i>Vulpia myuros</i>	<i>Hordeum murinum</i>	3958	Southside Drive
Big Oak Flat Road	4946	<i>Avena barbata</i>	<i>Hordeum murinum</i>	3959	Northside Drive
Big Oak Flat Road	4946	<i>Bromus diandrus</i>	<i>Hypericum perforatum</i>	3959	Northside Drive
Big Oak Flat Road	4946	<i>Bromus hordeaceus</i>	<i>Hypericum perforatum</i>	3964	Wawona Road
Big Oak Flat Road	4946	<i>Bromus tectorum</i>	<i>Hypericum perforatum</i>	4661	Tioga Road
Big Oak Flat Road	4946	<i>Cerastium glomeratum</i>	<i>Hypericum perforatum</i>	4946	Big Oak Flat Road
Big Oak Flat Road	4946	<i>Cynosurus echinatus</i>	<i>Hypericum perforatum</i>	5505	Hetch Hetchy Road
Big Oak Flat Road	4946	<i>Dactylis glomerata</i>	<i>Hypochaeris radicata</i>	3958	Southside Drive

Road	Elevation	Exotic Species	Exotic Species	Elevation	Road
Big Oak Flat Road	4946	<i>Erodium cicutarium</i>	<i>Lactuca serriola</i>	3842	El Portal Road
Big Oak Flat Road	4946	<i>Hypericum perforatum</i>	<i>Lactuca serriola</i>	3958	Southside Drive
Big Oak Flat Road	4946	<i>Lactuca serriola</i>	<i>Lactuca serriola</i>	3959	Northside Drive
Big Oak Flat Road	4946	<i>Lathyrus latifolius</i>	<i>Lactuca serriola</i>	3964	Wawona Road
Big Oak Flat Road	4946	<i>Phleum pratense</i>	<i>Lactuca serriola</i>	4661	Tioga Road
Big Oak Flat Road	4946	<i>Plantago lanceolata</i>	<i>Lactuca serriola</i>	4946	Big Oak Flat Road
Big Oak Flat Road	4946	<i>Poa bulbosa</i>	<i>Lactuca serriola</i>	5143	Wawona Road 2
Big Oak Flat Road	4946	<i>Polygonum arenastrum</i>	<i>Lactuca serriola</i>	5272	Big Oak Flat Road
Big Oak Flat Road	4946	<i>Sisymbrium altissimum</i>	<i>Lactuca serriola</i>	5969	Yosemite West
Big Oak Flat Road	4946	<i>Sonchus asper</i>	<i>Lactuca serriola</i>	6040	Wawona Road 3
Big Oak Flat Road	4946	<i>Vulpia myuros</i>	<i>Lactuca serriola</i>	6051	Wawona Road
Wawona Road 2	5143	<i>Bromus diandrus</i>	<i>Lathyrus latifolius</i>	4946	Big Oak Flat Road
Wawona Road 2	5143	<i>Bromus inermis</i>	<i>Leucanthemum maximum</i>	5969	Yosemite West
Wawona Road 2	5143	<i>Bromus tectorum</i>	<i>Lolium multiflorum</i>	5902	Big Oak Flat Road
Wawona Road 2	5143	<i>Centaurea solstitialis</i>	<i>Lolium multiflorum</i>	5969	Yosemite West
Wawona Road 2	5143	<i>Chenopodium album</i>	<i>Lolium perenne</i>	3958	Southside Drive
Wawona Road 2	5143	<i>Chenopodium botrys</i>	<i>Lolium perenne</i>	3959	Northside Drive
Wawona Road 2	5143	<i>Cirsium vulgare</i>	<i>Lolium perenne</i>	5969	Yosemite West
Wawona Road 2	5143	<i>Lactuca serriola</i>	<i>Phleum pratense</i>	4661	Tioga Road
Wawona Road 2	5143	<i>Plantago lanceolata</i>	<i>Phleum pratense</i>	4946	Big Oak Flat Road
Wawona Road 2	5143	<i>Poa annua</i>	<i>Plantago lanceolata</i>	3842	El Portal Road
Wawona Road 2	5143	<i>Poa pratensis</i>	<i>Plantago lanceolata</i>	3958	Southside Drive
Wawona Road 2	5143	<i>Polygonum arenastrum</i>	<i>Plantago lanceolata</i>	3959	Northside Drive
Wawona Road 2	5143	<i>Rumex acetosella</i>	<i>Plantago lanceolata</i>	3964	Wawona Road
Wawona Road 2	5143	<i>Silene latifolia</i>	<i>Plantago lanceolata</i>	4946	Big Oak Flat Road
Wawona Road 2	5143	<i>Vulpia myuros</i>	<i>Plantago lanceolata</i>	5143	Wawona Road 2
Big Oak Flat Road	5272	<i>Avena fatua</i>	<i>Plantago lanceolata</i>	5272	Big Oak Flat Road
Big Oak Flat Road	5272	<i>Bromus diandrus</i>	<i>Plantago lanceolata</i>	5902	Big Oak Flat Road
Big Oak Flat Road	5272	<i>Bromus hordeaceus</i>	<i>Plantago lanceolata</i>	5969	Yosemite West
Big Oak Flat Road	5272	<i>Bromus tectorum</i>	<i>Plantago lanceolata</i>	6040	Wawona Road 3
Big Oak Flat Road	5272	<i>Chenopodium album</i>	<i>Plantago lanceolata</i>	6051	Wawona Road
Big Oak Flat Road	5272	<i>Chenopodium botrys</i>	<i>Plantago lanceolata</i>	6254	Tioga Road
Big Oak Flat Road	5272	<i>Cynosurus echinatus</i>	<i>Plantago lanceolata</i>	6440	Glacier Point Road
Big Oak Flat Road	5272	<i>Herniaria hirsuta</i>	<i>Plantago major</i>	6051	Wawona Road
Big Oak Flat Road	5272	<i>Holcus lanatus</i>	<i>Plantago major</i>	6440	Glacier Point Road
Big Oak Flat Road	5272	<i>Lactuca serriola</i>	<i>Poa annua</i>	3959	Northside Drive
Big Oak Flat Road	5272	<i>Plantago lanceolata</i>	<i>Poa annua</i>	5143	Wawona Road 2
Big Oak Flat Road	5272	<i>Poa pratensis</i>	<i>Poa annua</i>	6040	Wawona Road 3
Big Oak Flat Road	5272	<i>Polygonum arenastrum</i>	<i>Poa annua</i>	6051	Wawona Road
Big Oak Flat Road	5272	<i>Rumex acetosella</i>	<i>Poa annua</i>	6254	Tioga Road
Big Oak Flat Road	5272	<i>Sonchus asper</i>	<i>Poa bulbosa</i>	3842	El Portal Road
Big Oak Flat Road	5272	<i>Vulpia myuros</i>	<i>Poa bulbosa</i>	3958	Southside Drive
Hetch Hetchy Road	5505	<i>Aira caryophylla</i>	<i>Poa bulbosa</i>	3959	Northside Drive
Hetch Hetchy Road	5505	<i>Avena barbata</i>	<i>Poa bulbosa</i>	3964	Wawona Road
Hetch Hetchy Road	5505	<i>Bromus hordeaceus</i>	<i>Poa bulbosa</i>	4661	Tioga Road
Hetch Hetchy Road	5505	<i>Bromus inermis</i>	<i>Poa bulbosa</i>	4946	Big Oak Flat Road
Hetch Hetchy Road	5505	<i>Bromus tectorum</i>	<i>Poa pratensis</i>	3842	El Portal Road
Hetch Hetchy Road	5505	<i>Hypericum perforatum</i>	<i>Poa pratensis</i>	3958	Southside Drive
Hetch Hetchy Road	5505	<i>Rumex acetosella</i>	<i>Poa pratensis</i>	3959	Northside Drive
Hetch Hetchy Road	5505	<i>Spergularia rubra</i>	<i>Poa pratensis</i>	3964	Wawona Road
Hetch Hetchy Road	5505	<i>Vulpia myuros</i>	<i>Poa pratensis</i>	5143	Wawona Road 2
Big Oak Flat Road	5902	<i>Bromus tectorum</i>	<i>Poa pratensis</i>	5272	Big Oak Flat Road
Big Oak Flat Road	5902	<i>Cirsium vulgare</i>	<i>Poa pratensis</i>	5969	Yosemite West
Big Oak Flat Road	5902	<i>Herniaria hirsuta</i>	<i>Poa pratensis</i>	6040	Wawona Road 3
Big Oak Flat Road	5902	<i>Lolium multiflorum</i>	<i>Poa pratensis</i>	6051	Wawona Road
Big Oak Flat Road	5902	<i>Plantago lanceolata</i>	<i>Polygonum arenastrum</i>	3842	El Portal Road
Big Oak Flat Road	5902	<i>Polygonum arenastrum</i>	<i>Polygonum arenastrum</i>	3958	Southside Drive
Big Oak Flat Road	5902	<i>Rumex acetosella</i>	<i>Polygonum arenastrum</i>	3959	Northside Drive
Big Oak Flat Road	5902	<i>Spergularia rubra</i>	<i>Polygonum arenastrum</i>	3964	Wawona Road
Yosemite West	5969	<i>Anthemis cotula</i>	<i>Polygonum arenastrum</i>	4661	Tioga Road

Road	Elevation	Exotic Species	Exotic Species	Elevation	Road
Yosemite West	5969	<i>Bromus tectorum</i>	<i>Polygonum arenastrum</i>	4946	Big Oak Flat Road
Yosemite West	5969	<i>Cerastium glomeratum</i>	<i>Polygonum arenastrum</i>	5143	Wawona Road 2
Yosemite West	5969	<i>Chenopodium album</i>	<i>Polygonum arenastrum</i>	5272	Big Oak Flat Road
Yosemite West	5969	<i>Chenopodium botrys</i>	<i>Polygonum arenastrum</i>	5902	Big Oak Flat Road
Yosemite West	5969	<i>Cirsium vulgare</i>	<i>Polygonum arenastrum</i>	5969	Yosemite West
Yosemite West	5969	<i>Lactuca serriola</i>	<i>Polygonum arenastrum</i>	6051	Wawona Road
Yosemite West	5969	<i>Leucanthemum maximum</i>	<i>Polygonum arenastrum</i>	6254	Tioga Road
Yosemite West	5969	<i>Lolium multiflorum</i>	<i>Polygonum arenastrum</i>	6254	Tioga Road
Yosemite West	5969	<i>Lolium perenne</i>	<i>Polygonum convolvulus</i>	3959	Northside Drive
Yosemite West	5969	<i>Plantago lanceolata</i>	<i>Raphanus raphanistrum</i>	5969	Yosemite West
Yosemite West	5969	<i>Poa pratensis</i>	<i>Raphanus sativus</i>	5969	Yosemite West
Yosemite West	5969	<i>Polygonum arenastrum</i>	<i>Rumex acetosella</i>	3958	Southside Drive
Yosemite West	5969	<i>Raphanus raphanistrum</i>	<i>Rumex acetosella</i>	3959	Northside Drive
Yosemite West	5969	<i>Raphanus sativus</i>	<i>Rumex acetosella</i>	3964	Wawona Road
Yosemite West	5969	<i>Rumex acetosella</i>	<i>Rumex acetosella</i>	5143	Wawona Road 2
Yosemite West	5969	<i>Sinapis arvensis</i>	<i>Rumex acetosella</i>	5272	Big Oak Flat Road
Yosemite West	5969	<i>Spergularia rubra</i>	<i>Rumex acetosella</i>	5505	Hetch Hetchy Road
Yosemite West	5969	<i>Trifolium repens</i>	<i>Rumex acetosella</i>	5902	Big Oak Flat Road
Yosemite West	5969	<i>Triticum aestivum</i>	<i>Rumex acetosella</i>	5969	Yosemite West
Yosemite West	5969	<i>Verbascum thapsus</i>	<i>Rumex acetosella</i>	6040	Wawona Road 3
Yosemite West	5969	<i>Vulpia myuros</i>	<i>Rumex acetosella</i>	6051	Wawona Road
Wawona Road 3	6040	<i>Agrostis gigantea</i>	<i>Rumex acetosella</i>	6179	Glacier Point Road
Wawona Road 3	6040	<i>Agrostis viridis</i>	<i>Rumex acetosella</i>	6254	Tioga Road
Wawona Road 3	6040	<i>Aira caryophylla</i>	<i>Rumex acetosella</i>	6440	Glacier Point Road
Wawona Road 3	6040	<i>Bromus inermis</i>	<i>Rumex acetosella</i>	7143	Tioga Road
Wawona Road 3	6040	<i>Bromus tectorum</i>	<i>Rumex acetosella</i>	8127	Tioga Road
Wawona Road 3	6040	<i>Cirsium vulgare</i>	<i>Rumex acetosella</i>	8150	Tioga Road
Wawona Road 3	6040	<i>Lactuca serriola</i>	<i>Rumex acetosella</i>	8472	Tioga Road
Wawona Road 3	6040	<i>Plantago lanceolata</i>	<i>Rumex crispus</i>	3959	Northside Drive
Wawona Road 3	6040	<i>Poa annua</i>	<i>Silene latifolia</i>	3958	Southside Drive
Wawona Road 3	6040	<i>Poa pratensis</i>	<i>Silene latifolia</i>	5143	Wawona Road 2
Wawona Road 3	6040	<i>Rumex acetosella</i>	<i>Silene latifolia</i>	6040	Wawona Road 3
Wawona Road 3	6040	<i>Silene latifolia</i>	<i>Sinapis arvensis</i>	5969	Yosemite West
Wawona Road 3	6040	<i>Tragopogon dubius</i>	<i>Sisymbrium altissimum</i>	3958	Southside Drive
Wawona Road 3	6040	<i>Vulpia myuros</i>	<i>Sisymbrium altissimum</i>	3959	Northside Drive
Wawona Road	6051	<i>Agrostis gigantea</i>	<i>Sisymbrium altissimum</i>	4946	Big Oak Flat Road
Wawona Road	6051	<i>Aira caryophylla</i>	<i>Sonchus asper</i>	3959	Northside Drive
Wawona Road	6051	<i>Bromus tectorum</i>	<i>Sonchus asper</i>	3964	Wawona Road
Wawona Road	6051	<i>Chenopodium album</i>	<i>Sonchus asper</i>	4946	Big Oak Flat Road
Wawona Road	6051	<i>Chenopodium botrys</i>	<i>Sonchus asper</i>	5272	Big Oak Flat Road
Wawona Road	6051	<i>Cirsium vulgare</i>	<i>Sonchus oleraceus</i>	4661	Tioga Road
Wawona Road	6051	<i>Holcus lanatus</i>	<i>Spergularia rubra</i>	3959	Northside Drive
Wawona Road	6051	<i>Lactuca serriola</i>	<i>Spergularia rubra</i>	3964	Wawona Road
Wawona Road	6051	<i>Plantago lanceolata</i>	<i>Spergularia rubra</i>	5505	Hetch Hetchy Road
Wawona Road	6051	<i>Plantago major</i>	<i>Spergularia rubra</i>	5902	Big Oak Flat Road
Wawona Road	6051	<i>Poa annua</i>	<i>Spergularia rubra</i>	5969	Yosemite West
Wawona Road	6051	<i>Poa pratensis</i>	<i>Spergularia rubra</i>	6051	Wawona Road
Wawona Road	6051	<i>Polygonum arenastrum</i>	<i>Spergularia rubra</i>	7143	Tioga Road
Wawona Road	6051	<i>Rumex acetosella</i>	<i>Spergularia rubra</i>	7176	Glacier Point Road
Wawona Road	6051	<i>Spergularia rubra</i>	<i>Spergularia rubra</i>	7704	Glacier Point Road
Wawona Road	6051	<i>Trifolium repens</i>	<i>Spergularia rubra</i>	7981	Tioga Road
Glacier Point Road	6179	<i>Rumex acetosella</i>	<i>Spergularia rubra</i>	8127	Tioga Road
Tioga Road	6254	<i>Cirsium vulgare</i>	<i>Spergularia rubra</i>	8150	Tioga Road
Tioga Road	6254	<i>Dactylis glomerata</i>	<i>Spergularia rubra</i>	8472	Tioga Road
Tioga Road	6254	<i>Plantago lanceolata</i>	<i>Spergularia rubra</i>	8674	Tioga Road
Tioga Road	6254	<i>Poa annua</i>	<i>Taraxacum officinale</i>	3958	Southside Drive
Tioga Road	6254	<i>Polygonum arenastrum</i>	<i>Taraxacum officinale</i>	3959	Northside Drive
Tioga Road	6254	<i>Polygonum arenastrum</i>	<i>Tragopogon dubius</i>	3958	Southside Drive
Tioga Road	6254	<i>Rumex acetosella</i>	<i>Tragopogon dubius</i>	3959	Northside Drive
Glacier Point Road	6440	<i>Cirsium vulgare</i>	<i>Tragopogon dubius</i>	6040	Wawona Road 3

Road	Elevation	Exotic Species	Exotic Species	Elevation	Road
Glacier Point Road	6440	<i>Plantago lanceolata</i>	<i>Trifolium hirtum</i>	3842	El Portal Road
Glacier Point Road	6440	<i>Plantago major</i>	<i>Trifolium repens</i>	3958	Southside Drive
Glacier Point Road	6440	<i>Rumex acetosella</i>	<i>Trifolium repens</i>	3959	Northside Drive
Tioga Road	7143	<i>Rumex acetosella</i>	<i>Trifolium repens</i>	5969	Yosemite West
Tioga Road	7143	<i>Spergularia rubra</i>	<i>Trifolium repens</i>	6051	Wawona Road
Glacier Point Road	7176	<i>Spergularia rubra</i>	<i>Triticum aestivum</i>	5969	Yosemite West
Glacier Point Road	7704	<i>Spergularia rubra</i>	<i>Verbascum thapsus</i>	3958	Southside Drive
Tioga Road	7981	<i>Bromus inermis</i>	<i>Verbascum thapsus</i>	5969	Yosemite West
Tioga Road	7981	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	3842	El Portal Road
Tioga Road	8127	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>	3959	Northside Drive
Tioga Road	8127	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	3964	Wawona Road
Tioga Road	8150	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>	4661	Tioga Road
Tioga Road	8150	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	4946	Big Oak Flat Road
Tioga Road	8472	<i>Bromus tectorum</i>	<i>Vulpia myuros</i>	5143	Wawona Road 2
Tioga Road	8472	<i>Herniaria hirsuta</i>	<i>Vulpia myuros</i>	5272	Big Oak Flat Road
Tioga Road	8472	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>	5505	Hetch Hetchy Road
Tioga Road	8472	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	5969	Yosemite West
Tioga Road	8674	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	6040	Wawona Road 3
<b>Species Richness Summary – by Road Section</b>			<b>Species Richness Summary - by Richness levels</b>		
Road	Elevation	Exotic Species Richness	Road	Elevation	Exotic Species Richness
Big Oak Flat Road	4661	17	Northside Drive	3959	31
Big Oak Flat Road	4946	18	Southside Drive	3958	26
Big Oak Flat Road	5272	16	Yosemite West	5969	22
Big Oak Flat Road	5902	8	Wawona Road	3964	20
Glacier Point Road	6179	1	El Portal Road	3842	18
Glacier Point Road	6440	4	Big Oak Flat Road	4946	18
Glacier Point Road	7176	1	Big Oak Flat Road	4661	17
Glacier Point Road	7704	1	Big Oak Flat Road	5272	16
Hetch Hetchy Road	5505	9	Wawona Road	6051	16
El Portal Road	3842	18	Wawona Road	5142	15
Northside Drive	3959	31	Wawona Road	6040	14
Southside Drive	3958	26	Hetch Hetchy Road	5505	9
Tioga Road	6254	7	Big Oak Flat Road	5902	8
Tioga Road	7143	2	Tioga Road	6254	7
Tioga Road	7981	2	Glacier Point Road	6440	4
Tioga Road	8127	2	Tioga Road	8472	4
Tioga Road	8150	2	Tioga Road	7143	2
Tioga Road	8472	4	Tioga Road	7981	2
Tioga Road	8674	1	Tioga Road	8127	2
Wawona Road	3964	20	Tioga Road	8150	2
Wawona Road	5142	15	Glacier Point Road	6179	1
Wawona Road	6040	14	Glacier Point Road	7176	1
Wawona Road	6051	16	Glacier Point Road	7704	1
Yosemite West	5969	22	Tioga Road	8674	1
<b>Total Roadside Species</b>		<b>Total = 58</b>	<b>Total Roadside Species</b>		<b>Total = 58</b>

Appendix E. Yosemite National Park exotic plant species of trailsides.

Trail	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Trail
Mirror Lake Pack	3931	<i>Bromus diandrus</i>	<i>Agrostis gigantea</i>	3972	Yosemite Loop
Mirror Lake Pack	3931	<i>Bromus tectorum</i>	<i>Agrostis gigantea</i>	4053	Meadow Loop
Mirror Lake Pack	3931	<i>Cirsium vulgare</i>	<i>Agrostis gigantea</i>	4100	Snow Creek
Mirror Lake Pack	3931	<i>Holcus lanatus</i>	<i>Agrostis gigantea</i>	4770	Old Big Oak Flat Rd.
Mirror Lake Pack	3931	<i>Hordeum murinum</i>	<i>Agrostis gigantea</i>	4959	Happy Isles
Mirror Lake Pack	3931	<i>Lactuca serriola</i>	<i>Aira caryophylla</i>	4036	Bridalveil-Inspiration Pt.
Mirror Lake Pack	3931	<i>Phleum pratense</i>	<i>Aira caryophylla</i>	4053	Meadow Loop
Mirror Lake Pack	3931	<i>Plantago lanceolata</i>	<i>Aira caryophylla</i>	4100	Snow Creek
Mirror Lake Pack	3931	<i>Poa annua</i>	<i>Aira caryophylla</i>	4417	Chilnaulna Falls
Mirror Lake Pack	3931	<i>Poa pratensis</i>	<i>Aira caryophylla</i>	4557	Alder Creek
Mirror Lake Pack	3931	<i>Polygonum arenastrum</i>	<i>Aira caryophylla</i>	4770	Old Big Oak Flat Rd.
Mirror Lake Pack	3931	<i>Rubus discolor</i>	<i>Aira caryophylla</i>	5256	Two Hour
Mirror Lake Pack	3931	<i>Trifolium repens</i>	<i>Avena barbata</i>	4100	Snow Creek
Mirror Lake Pack	3931	<i>Vulpia myuros</i>	<i>Barbarea vulgaris</i>	4959	Happy Isles
Four Mile	3960	<i>Bromus tectorum</i>	<i>Bromus arenarius</i>	5256	Two Hour
Four Mile	3960	<i>Chenopodium botrys</i>	<i>Bromus diandrus</i>	3931	Mirror Lake Pack
Four Mile	3960	<i>Erodium cicutarium</i>	<i>Bromus diandrus</i>	3972	Yosemite Loop
Four Mile	3960	<i>Holcus lanatus</i>	<i>Bromus diandrus</i>	4053	Meadow Loop
Four Mile	3960	<i>Poa annua</i>	<i>Bromus diandrus</i>	4100	Snow Creek
Four Mile	3960	<i>Poa bulbosa</i>	<i>Bromus hordeaceus</i>	3972	Yosemite Loop
Four Mile	3960	<i>Poa pratensis</i>	<i>Bromus hordeaceus</i>	4035	Bridalveil Falls
Four Mile	3960	<i>Rumex acetosella</i>	<i>Bromus hordeaceus</i>	4053	Meadow Loop
Four Mile	3960	<i>Silene latifolia</i>	<i>Bromus inermis</i>	4053	Meadow Loop
Four Mile	3960	<i>Taraxacum officinale</i>	<i>Bromus inermis</i>	4959	Happy Isles
Four Mile	3960	<i>Vulpia myuros</i>	<i>Bromus inermis</i>	7243	Panorama
Yosemite Loop	3972	<i>Agrostis gigantea</i>	<i>Bromus sterilis</i>	4015	Yosemite Falls
Yosemite Loop	3972	<i>Bromus diandrus</i>	<i>Bromus sterilis</i>	4100	Snow Creek
Yosemite Loop	3972	<i>Bromus hordeaceus</i>	<i>Bromus sterilis</i>	4770	Old Big Oak Flat Rd.
Yosemite Loop	3972	<i>Bromus tectorum</i>	<i>Bromus tectorum</i>	3931	Mirror Lake Pack
Yosemite Loop	3972	<i>Chenopodium album</i>	<i>Bromus tectorum</i>	3960	Four Mile
Yosemite Loop	3972	<i>Cirsium vulgare</i>	<i>Bromus tectorum</i>	3972	Yosemite Loop
Yosemite Loop	3972	<i>Cynosurus echinatus</i>	<i>Bromus tectorum</i>	4015	Yosemite Falls
Yosemite Loop	3972	<i>Galium parisiense</i>	<i>Bromus tectorum</i>	4035	Bridalveil Falls
Yosemite Loop	3972	<i>Holcus lanatus</i>	<i>Bromus tectorum</i>	4036	Bridalveil-Inspiration Pt.
Yosemite Loop	3972	<i>Hordeum murinum</i>	<i>Bromus tectorum</i>	4053	Meadow Loop
Yosemite Loop	3972	<i>Lactuca serriola</i>	<i>Bromus tectorum</i>	4100	Snow Creek
Yosemite Loop	3972	<i>Phleum pratense</i>	<i>Bromus tectorum</i>	4381	Inspiration Pt.
Yosemite Loop	3972	<i>Poa annua</i>	<i>Bromus tectorum</i>	4417	Chilnaulna Falls
Yosemite Loop	3972	<i>Poa bulbosa</i>	<i>Bromus tectorum</i>	4557	Alder Creek
Yosemite Loop	3972	<i>Poa pratensis</i>	<i>Bromus tectorum</i>	4770	Old Big Oak Flat Rd.
Yosemite Loop	3972	<i>Polygonum arenastrum</i>	<i>Bromus tectorum</i>	4959	Happy Isles
Yosemite Loop	3972	<i>Rubus discolor</i>	<i>Bromus tectorum</i>	5256	Two Hour
Yosemite Loop	3972	<i>Rumex acetosella</i>	<i>Bromus tectorum</i>	7243	Panorama
Yosemite Loop	3972	<i>Rumex crispus</i>	<i>Capsella bursa-pastoris</i>	8622	Young Lake
Yosemite Loop	3972	<i>Sonchus asper</i>	<i>Cerastium glomeratum</i>	4053	Meadow Loop
Yosemite Loop	3972	<i>Spergularia rubra</i>	<i>Cerastium glomeratum</i>	4100	Snow Creek
Yosemite Loop	3972	<i>Taraxacum officinale</i>	<i>Cerastium glomeratum</i>	4959	Happy Isles
Yosemite Loop	3972	<i>Torilis arvensis</i>	<i>Cerastium glomeratum</i>	6339	Tamarack Creek
Yosemite Loop	3972	<i>Tragopogon dubius</i>	<i>Chenopodium album</i>	3972	Yosemite Loop
Yosemite Loop	3972	<i>Verbascum thapsus</i>	<i>Chenopodium album</i>	4381	Inspiration Pt.
Yosemite Loop	3972	<i>Vulpia myuros</i>	<i>Chenopodium botrys</i>	3960	Four Mile
Yosemite Falls	4015	<i>Bromus sterilis</i>	<i>Cirsium vulgare</i>	3931	Mirror Lake Pack
Yosemite Falls	4015	<i>Bromus tectorum</i>	<i>Cirsium vulgare</i>	3972	Yosemite Loop
Yosemite Falls	4015	<i>Galium parisiense</i>	<i>Cirsium vulgare</i>	4036	Bridalveil-Inspiration Pt.
Yosemite Falls	4015	<i>Holcus lanatus</i>	<i>Cirsium vulgare</i>	4053	Meadow Loop
Yosemite Falls	4015	<i>Hypericum perforatum</i>	<i>Cirsium vulgare</i>	4770	Old Big Oak Flat Rd.
Yosemite Falls	4015	<i>Lactuca serriola</i>	<i>Cirsium vulgare</i>	4959	Happy Isles
Yosemite Falls	4015	<i>Sonchus oleraceus</i>	<i>Cirsium vulgare</i>	5256	Two Hour

Trail	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Trail
Yosemite Falls	4015	<i>Vulpia myuros</i>	<i>Cirsium vulgare</i>	7243	Panorama
Bridalveil Falls	4035	<i>Bromus hordeaceus</i>	<i>Cynosurus echinatus</i>	3972	Yosemite Loop
Bridalveil Falls	4035	<i>Bromus tectorum</i>	<i>Cynosurus echinatus</i>	4053	Meadow Loop
Bridalveil Falls	4035	<i>Poa bulbosa</i>	<i>Dactylis glomerata</i>	4771	Merced Grove
Bridalveil Falls	4035	<i>Poa pratensis</i>	<i>Erodium cicutarium</i>	3960	Four Mile
Bridalveil Falls	4035	<i>Silene latifolia</i>	<i>Erodium cicutarium</i>	4053	Meadow Loop
Bridalveil Falls	4035	<i>Stellaria media</i>	<i>Festuca pratensis</i>	5256	Two Hour
Bridalveil Falls	4035	<i>Vulpia myuros</i>	<i>Galium parisiense</i>	3972	Yosemite Loop
Bridalveil-Inspiration Pt.	4036	<i>Aira caryophylla</i>	<i>Galium parisiense</i>	4015	Yosemite Falls
Bridalveil-Inspiration Pt.	4036	<i>Bromus tectorum</i>	<i>Galium parisiense</i>	4053	Meadow Loop
Bridalveil-Inspiration Pt.	4036	<i>Cirsium vulgare</i>	<i>Galium parisiense</i>	4959	Happy Isles
Bridalveil-Inspiration Pt.	4036	<i>Holcus lanatus</i>	<i>Galium parisiense</i>	5256	Two Hour
Bridalveil-Inspiration Pt.	4036	<i>Sonchus asper</i>	<i>Herniaria hirsuta</i>	4053	Meadow Loop
Bridalveil-Inspiration Pt.	4036	<i>Vulpia myuros</i>	<i>Holcus lanatus</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Agrostis gigantea</i>	<i>Holcus lanatus</i>	3960	Four Mile
Meadow Loop	4053	<i>Aira caryophylla</i>	<i>Holcus lanatus</i>	3972	Yosemite Loop
Meadow Loop	4053	<i>Bromus diandrus</i>	<i>Holcus lanatus</i>	4015	Yosemite Falls
Meadow Loop	4053	<i>Bromus hordeaceus</i>	<i>Holcus lanatus</i>	4036	Bridalveil-Inspiration Pt.
Meadow Loop	4053	<i>Bromus inermis</i>	<i>Holcus lanatus</i>	4053	Meadow Loop
Meadow Loop	4053	<i>Bromus tectorum</i>	<i>Holcus lanatus</i>	4417	Chilnaulna Falls
Meadow Loop	4053	<i>Cerastium glomeratum</i>	<i>Holcus lanatus</i>	4557	Alder Creek
Meadow Loop	4053	<i>Cirsium vulgare</i>	<i>Holcus lanatus</i>	4770	Old Big Oak Flat Rd.
Meadow Loop	4053	<i>Cynosurus echinatus</i>	<i>Holcus lanatus</i>	4959	Happy Isles
Meadow Loop	4053	<i>Erodium cicutarium</i>	<i>Holcus lanatus</i>	5256	Two Hour
Meadow Loop	4053	<i>Galium parisiense</i>	<i>Hordeum murinum</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Herniaria hirsuta</i>	<i>Hordeum murinum</i>	3972	Yosemite Loop
Meadow Loop	4053	<i>Holcus lanatus</i>	<i>Hypericum perforatum</i>	4015	Yosemite Falls
Meadow Loop	4053	<i>Lathyrus latifolius</i>	<i>Hypericum perforatum</i>	4557	Alder Creek
Meadow Loop	4053	<i>Phleum pratense</i>	<i>Lactuca serriola</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Plantago lanceolata</i>	<i>Lactuca serriola</i>	3972	Yosemite Loop
Meadow Loop	4053	<i>Plantago major</i>	<i>Lactuca serriola</i>	4015	Yosemite Falls
Meadow Loop	4053	<i>Poa bulbosa</i>	<i>Lactuca serriola</i>	4770	Old Big Oak Flat Rd.
Meadow Loop	4053	<i>Poa pratensis</i>	<i>Lactuca serriola</i>	5256	Two Hour
Meadow Loop	4053	<i>Polygonum arenastrum</i>	<i>Lathyrus latifolius</i>	4053	Meadow Loop
Meadow Loop	4053	<i>Rubus discolor</i>	<i>Lolium multiflorum</i>	4959	Happy Isles
Meadow Loop	4053	<i>Rubus laciniatus</i>	<i>Phleum pratense</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Rumex acetosella</i>	<i>Phleum pratense</i>	3972	Yosemite Loop
Meadow Loop	4053	<i>Sisymbrium altissimum</i>	<i>Phleum pratense</i>	4053	Meadow Loop
Meadow Loop	4053	<i>Sonchus asper</i>	<i>Plantago lanceolata</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Sonchus oleraceus</i>	<i>Plantago lanceolata</i>	4053	Meadow Loop
Meadow Loop	4053	<i>Stellaria media</i>	<i>Plantago major</i>	4053	Meadow Loop
Meadow Loop	4053	<i>Taraxacum officinale</i>	<i>Poa annua</i>	3931	Mirror Lake Pack
Meadow Loop	4053	<i>Tragopogon dubius</i>	<i>Poa annua</i>	3960	Four Mile
Meadow Loop	4053	<i>Trifolium repens</i>	<i>Poa annua</i>	3972	Yosemite Loop
Meadow Loop	4053	<i>Verbascum thapsus</i>	<i>Poa annua</i>	4381	Inspiration Pt.
Meadow Loop	4053	<i>Vulpia myuros</i>	<i>Poa annua</i>	5256	Two Hour
Snow Creek	4100	<i>Agrostis gigantea</i>	<i>Poa annua</i>	6969	Bridalveil Creek
Snow Creek	4100	<i>Aira caryophylla</i>	<i>Poa annua</i>	7729	Taft Point
Snow Creek	4100	<i>Avena barbata</i>	<i>Poa annua</i>	7821	Harden Lake
Snow Creek	4100	<i>Bromus diandrus</i>	<i>Poa bulbosa</i>	3960	Four Mile
Snow Creek	4100	<i>Bromus sterilis</i>	<i>Poa bulbosa</i>	3972	Yosemite Loop
Snow Creek	4100	<i>Bromus tectorum</i>	<i>Poa bulbosa</i>	4035	Bridalveil Falls
Snow Creek	4100	<i>Cerastium glomeratum</i>	<i>Poa bulbosa</i>	4053	Meadow Loop
Snow Creek	4100	<i>Poa pratensis</i>	<i>Poa compressa</i>	4417	Chilnaulna Falls
Snow Creek	4100	<i>Vulpia myuros</i>	<i>Poa pratensis</i>	3931	Mirror Lake Pack
Inspiration Pt.	4381	<i>Bromus tectorum</i>	<i>Poa pratensis</i>	3960	Four Mile
Inspiration Pt.	4381	<i>Chenopodium album</i>	<i>Poa pratensis</i>	3972	Yosemite Loop
Inspiration Pt.	4381	<i>Poa annua</i>	<i>Poa pratensis</i>	4035	Bridalveil Falls
Inspiration Pt.	4381	<i>Scorzonera hispanica</i>	<i>Poa pratensis</i>	4053	Meadow Loop



Trail	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Trail
Inspiration Pt.	4381	<i>Silene latifolia</i>	<i>Poa pratensis</i>	4100	Snow Creek
Chilnaulna Falls	4417	<i>Aira caryophyllea</i>	<i>Poa pratensis</i>	4557	Alder Creek
Chilnaulna Falls	4417	<i>Bromus tectorum</i>	<i>Poa pratensis</i>	4959	Happy Isles
Chilnaulna Falls	4417	<i>Holcus lanatus</i>	<i>Poa pratensis</i>	5256	Two Hour
Chilnaulna Falls	4417	<i>Poa compressa</i>	<i>Poa pratensis</i>	6969	Bridalveil Creek
Chilnaulna Falls	4417	<i>Sonchus asper</i>	<i>Poa pratensis</i>	8622	Young Lake
Chilnaulna Falls	4417	<i>Vulpia myuros</i>	<i>Poa pratensis</i>	8686	Glen Aulin
Alder Creek	4557	<i>Aira caryophyllea</i>	<i>Polygonum arenastrum</i>	3931	Mirror Lake Pack
Alder Creek	4557	<i>Bromus tectorum</i>	<i>Polygonum arenastrum</i>	3972	Yosemite Loop
Alder Creek	4557	<i>Holcus lanatus</i>	<i>Polygonum arenastrum</i>	4053	Meadow Loop
Alder Creek	4557	<i>Hypericum perforatum</i>	<i>Rubus discolor</i>	3931	Mirror Lake Pack
Alder Creek	4557	<i>Poa pratensis</i>	<i>Rubus discolor</i>	3972	Yosemite Loop
Alder Creek	4557	<i>Rumex acetosella</i>	<i>Rubus discolor</i>	4053	Meadow Loop
Alder Creek	4557	<i>Vulpia myuros</i>	<i>Rubus laciniatus</i>	4053	Meadow Loop
Old Big Oak Flat Rd.	4770	<i>Agrostis gigantea</i>	<i>Rumex acetosella</i>	3960	Four Mile
Old Big Oak Flat Rd.	4770	<i>Aira caryophyllea</i>	<i>Rumex acetosella</i>	3972	Yosemite Loop
Old Big Oak Flat Rd.	4770	<i>Bromus sterilis</i>	<i>Rumex acetosella</i>	4053	Meadow Loop
Old Big Oak Flat Rd.	4770	<i>Bromus tectorum</i>	<i>Rumex acetosella</i>	4557	Alder Creek
Old Big Oak Flat Rd.	4770	<i>Cirsium vulgare</i>	<i>Rumex acetosella</i>	4771	Merced Grove
Old Big Oak Flat Rd.	4770	<i>Holcus lanatus</i>	<i>Rumex acetosella</i>	6339	Tamarack Creek
Old Big Oak Flat Rd.	4770	<i>Lactuca serriola</i>	<i>Rumex acetosella</i>	7821	Harden Lake
Old Big Oak Flat Rd.	4770	<i>Tragopogon dubius</i>	<i>Rumex acetosella</i>	8100	Porcupine Creek
Old Big Oak Flat Rd.	4770	<i>Vulpia myuros</i>	<i>Rumex crispus</i>	3972	Yosemite Loop
Merced Grove	4771	<i>Dactylis glomerata</i>	<i>Scorzonera hispanica</i>	4381	Inspiration Pt.
Merced Grove	4771	<i>Rumex acetosella</i>	<i>Silene latifolia</i>	3960	Four Mile
Happy Isles	4959	<i>Agrostis gigantea</i>	<i>Silene latifolia</i>	4035	Bridalveil Falls
Happy Isles	4959	<i>Barbarea vulgaris</i>	<i>Silene latifolia</i>	4381	Inspiration Pt.
Happy Isles	4959	<i>Bromus inermis</i>	<i>Silene latifolia</i>	5256	Two Hour
Happy Isles	4959	<i>Bromus tectorum</i>	<i>Sisymbrium altissimum</i>	4053	Meadow Loop
Happy Isles	4959	<i>Cerastium glomeratum</i>	<i>Sisymbrium altissimum</i>	4959	Happy Isles
Happy Isles	4959	<i>Cirsium vulgare</i>	<i>Sonchus asper</i>	3972	Yosemite Loop
Happy Isles	4959	<i>Galium parisiense</i>	<i>Sonchus asper</i>	4036	Bridalveil-Inspiration Pt.
Happy Isles	4959	<i>Holcus lanatus</i>	<i>Sonchus asper</i>	4053	Meadow Loop
Happy Isles	4959	<i>Lolium multiflorum</i>	<i>Sonchus asper</i>	4417	Chilnaulna Falls
Happy Isles	4959	<i>Poa pratensis</i>	<i>Sonchus oleraceus</i>	4015	Yosemite Falls
Happy Isles	4959	<i>Sisymbrium altissimum</i>	<i>Sonchus oleraceus</i>	4053	Meadow Loop
Happy Isles	4959	<i>Vulpia myuros</i>	<i>Spergularia rubra</i>	3972	Yosemite Loop
Two Hour	5256	<i>Aira caryophyllea</i>	<i>Spergularia rubra</i>	6339	Tamarack Creek
Two Hour	5256	<i>Bromus arenarius</i>	<i>Spergularia rubra</i>	7243	Panorama
Two Hour	5256	<i>Bromus tectorum</i>	<i>Spergularia rubra</i>	7821	Harden Lake
Two Hour	5256	<i>Cirsium vulgare</i>	<i>Spergularia rubra</i>	7886	Lukens Lake
Two Hour	5256	<i>Festuca pratensis</i>	<i>Spergularia rubra</i>	8675	John Muir-Tuolumne
Two Hour	5256	<i>Galium parisiense</i>	<i>Spergularia rubra</i>	8686	Glen Aulin
Two Hour	5256	<i>Holcus lanatus</i>	<i>Stellaria media</i>	4035	Bridalveil Falls
Two Hour	5256	<i>Lactuca serriola</i>	<i>Stellaria media</i>	4053	Meadow Loop
Two Hour	5256	<i>Poa annua</i>	<i>Taraxacum officinale</i>	3960	Four Mile
Two Hour	5256	<i>Poa pratensis</i>	<i>Taraxacum officinale</i>	3972	Yosemite Loop
Two Hour	5256	<i>Silene latifolia</i>	<i>Taraxacum officinale</i>	4053	Meadow Loop
Two Hour	5256	<i>Taraxacum officinale</i>	<i>Taraxacum officinale</i>	5256	Two Hour
Two Hour	5256	<i>Vulpia myuros</i>	<i>Taraxacum officinale</i>	7821	Harden Lake
Tamarack Creek	6339	<i>Cerastium glomeratum</i>	<i>Taraxacum officinale</i>	7886	Lukens Lake
Tamarack Creek	6339	<i>Rumex acetosella</i>	<i>Taraxacum officinale</i>	8675	John Muir-Tuolumne
Tamarack Creek	6339	<i>Spergularia rubra</i>	<i>Torilis arvensis</i>	3972	Yosemite Loop
Bridalveil Creek	6969	<i>Poa annua</i>	<i>Tragopogon dubius</i>	3972	Yosemite Loop
Bridalveil Creek	6969	<i>Poa pratensis</i>	<i>Tragopogon dubius</i>	4053	Meadow Loop
Panorama	7243	<i>Bromus inermis</i>	<i>Tragopogon dubius</i>	4770	Old Big Oak Flat Rd.
Panorama	7243	<i>Bromus tectorum</i>	<i>Trifolium repens</i>	3931	Mirror Lake Pack
Panorama	7243	<i>Cirsium vulgare</i>	<i>Trifolium repens</i>	4053	Meadow Loop
Panorama	7243	<i>Spergularia rubra</i>	<i>Trifolium repens</i>	8686	Glen Aulin

Trail	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Trail
Taft Point	7729	<i>Poa annua</i>	<i>Verbascum thapsus</i>	3972	Yosemite Loop
Harden Lake	7821	<i>Poa annua</i>	<i>Verbascum thapsus</i>	4053	Meadow Loop
Harden Lake	7821	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>	3931	Mirror Lake Pack
Harden Lake	7821	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	3960	Four Mile
Harden Lake	7821	<i>Taraxacum officinale</i>	<i>Vulpia myuros</i>	3972	Yosemite Loop
Lukens Lake	7886	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	4015	Yosemite Falls
Lukens Lake	7886	<i>Taraxacum officinale</i>	<i>Vulpia myuros</i>	4035	Bridalveil Falls
Porcupine Creek	8100	<i>Rumex acetosella</i>	<i>Vulpia myuros</i>	4036	Bridalveil-Inspiration Pt.
Young Lakes	8622	<i>Capsella bursa-pastoris</i>	<i>Vulpia myuros</i>	4053	Meadow Loop
Young Lakes	8622	<i>Poa pratensis</i>	<i>Vulpia myuros</i>	4100	Snow Creek
John Muir-Tuolumne	8675	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	4417	Chilnaulna Falls
John Muir-Tuolumne	8675	<i>Taraxacum officinale</i>	<i>Vulpia myuros</i>	4557	Alder Creek
Glen Aulin	8686	<i>Poa pratensis</i>	<i>Vulpia myuros</i>	4770	Old Big Oak Flat Rd.
Glen Aulin	8686	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	4959	Happy Isles
Glen Aulin	8686	<i>Trifolium repens</i>	<i>Vulpia myuros</i>	5256	Two Hour
<b>Trail Species Richness Summary – by Trail</b>			<b>Trail Species Richness Summary – by Richness Levels</b>		
Trail	Elevation (ft)	Exotic Species Richness	Trail	Elevation (ft)	Exotic Species Richness
Alder Creek	4557	7	Meadow Loop	4053	32
Bridalveil Creek	6969	2	Yosemite Loop	3972	26
Bridalveil Falls	4035	7	Mirror Lake Pack	3931	14
Bridalveil-Inspiration Pt.	4036	6	Two Hour	5256	13
Chilnaulna Falls	4417	6	Happy Isles	4959	12
Four Mile	3960	11	Four Mile	3960	11
Glen Aulin	8686	3	Old Big Oak Flat Rd.	4770	9
Happy Isles	4959	12	Snow Creek	4100	9
Harden Lake	7821	4	Yosemite Falls	4015	8
Inspiration Pt.	4381	5	Alder Creek	4557	7
John Muir-Tuolumne	8675	2	Bridalveil Falls	4035	7
Lukens Lake	7886	2	Bridalveil-Inspiration Pt.	4036	6
Meadow Loop	4053	32	Chilnaulna Falls	4417	6
Merced Grove	4771	2	Inspiration Pt.	4381	5
Mirror Lake Pack	3931	14	Harden Lake	7821	4
Old Big Oak Flat Rd.	4770	9	Panorama	7243	4
Panorama	7243	4	Glen Aulin	8686	3
Porcupine Creek	8100	1	Tamarack Creek	6339	3
Snow Creek	4100	9	Bridalveil Creek	6969	2
Taft Point	7729	1	John Muir-Tuolumne	8675	2
Tamarack Creek	6339	3	Lukens Lake	7886	2
Two Hour	5256	13	Merced Grove	4771	2
Yosemite Falls	4015	8	Young Lakes	8622	2
Yosemite Loop	3972	26	Porcupine Creek	8100	1
Young Lakes	8622	2	Taft Point	7729	1
<b>Trailside Species</b>		<b>Total = 52</b>	<b>Trailside Species</b>		<b>Total = 52</b>

Appendix F. Yosemite National Park exotic plant species of corrals and stables.

Site	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Site
Hetch Hetchy Corral	3960	<i>Aira caryophyllaea</i>	<i>Agrostis gigantea</i>	4000	Concession Stables (YV)
Hetch Hetchy Corral	3960	<i>Avena barbata</i>	<i>Aira caryophyllaea</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Bromus diandrus</i>	<i>Aira caryophyllaea</i>	4001	Wawona Stables
Hetch Hetchy Corral	3960	<i>Bromus hordeaceus</i>	<i>Aira caryophyllaea</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Bromus sterilis</i>	<i>Avena barbata</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Bromus tectorum</i>	<i>Bromus catharticus</i>	8695	Government Corrals (Tuol)
Hetch Hetchy Corral	3960	<i>Capsella bursa-pastoris</i>	<i>Bromus diandrus</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Centaurea solstitialis</i>	<i>Bromus diandrus</i>	4000	Concession Stables (YV)
Hetch Hetchy Corral	3960	<i>Cerastium glomeratum</i>	<i>Bromus diandrus</i>	4001	Wawona Stables
Hetch Hetchy Corral	3960	<i>Chamomilla suaveolens</i>	<i>Bromus diandrus</i>	4039	Government Stables (YV)
Hetch Hetchy Corral	3960	<i>Chenopodium botrys</i>	<i>Bromus diandrus</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Cynosurus echinatus</i>	<i>Bromus hordeaceus</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Erodium cicutarium</i>	<i>Bromus hordeaceus</i>	4001	Wawona Stables
Hetch Hetchy Corral	3960	<i>Filago gallica</i>	<i>Bromus hordeaceus</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Galium parisiense</i>	<i>Bromus inermis</i>	4000	Concession Stables (YV)
Hetch Hetchy Corral	3960	<i>Herniaria hirsuta</i>	<i>Bromus inermis</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Hordeum murinum</i>	<i>Bromus secalinus</i>	4000	Concession Stables (YV)
Hetch Hetchy Corral	3960	<i>Lactuca serriola</i>	<i>Bromus sterilis</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Malva parviflora</i>	<i>Bromus sterilis</i>	4039	Government Stables (YV)
Hetch Hetchy Corral	3960	<i>Parapholis incurva</i>	<i>Bromus tectorum</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Poa annua</i>	<i>Bromus tectorum</i>	4000	Concession Stables (YV)
Hetch Hetchy Corral	3960	<i>Poa bulbosa</i>	<i>Bromus tectorum</i>	4001	Wawona Stables
Hetch Hetchy Corral	3960	<i>Poa pratensis</i>	<i>Bromus tectorum</i>	4039	Government Stables (YV)
Hetch Hetchy Corral	3960	<i>Polygonum arenastrum</i>	<i>Bromus tectorum</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Polypogon maritimus</i>	<i>Capsella bursa-pastoris</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Rumex acetosella</i>	<i>Capsella bursa-pastoris</i>	4039	Government Stables (YV)
Hetch Hetchy Corral	3960	<i>Rumex crispus</i>	<i>Capsella bursa-pastoris</i>	7496	Harden Lake Corral
Hetch Hetchy Corral	3960	<i>Sonchus oleraceus</i>	<i>Capsella bursa-pastoris</i>	7967	White Wolf Corral
Hetch Hetchy Corral	3960	<i>Stellaria media</i>	<i>Centaurea solstitialis</i>	3960	Hetch Hetchy Corral
Hetch Hetchy Corral	3960	<i>Torilis arvensis</i>	<i>Centaurea solstitialis</i>	4093	McCauley Ranch
Hetch Hetchy Corral	3960	<i>Vulpia myuros</i>	<i>Cerastium glomeratum</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Agrostis gigantea</i>	<i>Cerastium glomeratum</i>	4000	Concession Stables (YV)
Concession Stables (YV)	4000	<i>Bromus diandrus</i>	<i>Chamomilla suaveolens</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Bromus inermis</i>	<i>Chamomilla suaveolens</i>	4001	Wawona Stables
Concession Stables (YV)	4000	<i>Bromus secalinus</i>	<i>Chamomilla suaveolens</i>	7967	White Wolf Corral
Concession Stables (YV)	4000	<i>Bromus tectorum</i>	<i>Chenopodium botrys</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Cerastium glomeratum</i>	<i>Chenopodium botrys</i>	4039	Government Stables (YV)
Concession Stables (YV)	4000	<i>Cirsium vulgare</i>	<i>Cirsium vulgare</i>	4000	Concession Stables (YV)
Concession Stables (YV)	4000	<i>Dactylis glomerata</i>	<i>Cirsium vulgare</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Dianthus barbatus</i>	<i>Convolvulus arvensis</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Holcus lanatus</i>	<i>Cynodon dactylon</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Hordeum murinum</i>	<i>Cynosurus echinatus</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Hypericum perforatum</i>	<i>Cynosurus echinatus</i>	4001	Wawona Stables
Concession Stables (YV)	4000	<i>Lactuca serriola</i>	<i>Cynosurus echinatus</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Leucanthemum vulgare</i>	<i>Dactylis glomerata</i>	4000	Concession Stables (YV)
Concession Stables (YV)	4000	<i>Lolium perenne</i>	<i>Dactylis glomerata</i>	8632	Tuolumne Stables
Concession Stables (YV)	4000	<i>Lychnis coronaria</i>	<i>Dianthus barbatus</i>	4000	Concession Stables (YV)
Concession Stables (YV)	4000	<i>Phleum pratense</i>	<i>Erodium cicutarium</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Plantago lanceolata</i>	<i>Erodium cicutarium</i>	4001	Wawona Stables
Concession Stables (YV)	4000	<i>Poa annua</i>	<i>Erodium cicutarium</i>	4039	Government Stables (YV)
Concession Stables (YV)	4000	<i>Poa bulbosa</i>	<i>Erodium cicutarium</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Poa pratensis</i>	<i>Filago gallica</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Polygonum arenastrum</i>	<i>Galium parisiense</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Rubus discolor</i>	<i>Galium parisiense</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Rumex acetosella</i>	<i>Herniaria hirsuta</i>	3960	Hetch Hetchy Corral
Concession Stables (YV)	4000	<i>Rumex crispus</i>	<i>Herniaria hirsuta</i>	4001	Wawona Stables
Concession Stables (YV)	4000	<i>Silene latifolia</i>	<i>Herniaria hirsuta</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Sonchus oleraceus</i>	<i>Herniaria hirsuta</i>	7496	Harden Lake Corral
Concession Stables (YV)	4000	<i>Stellaria media</i>	<i>Herniaria hirsuta</i>	8632	Tuolumne Stables

Site	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Site
Concession Stables (YV)	4000	<i>Taraxacum officinale</i>	<i>Holcus lanatus</i>	4000	Concession Stables (YV)
Concession Stables (YV)	4000	<i>Tragopogon dubius</i>	<i>Holcus lanatus</i>	4001	Wawona Stables
Concession Stables (YV)	4000	<i>Trifolium repens</i>	<i>Holcus lanatus</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Verbascum thapsus</i>	<i>Hordeum marinum</i>	4093	McCauley Ranch
Concession Stables (YV)	4000	<i>Vulpia myuros</i>	<i>Hordeum murinum</i>	3960	Hetch Hetchy Corral
Wawona Stables	4001	<i>Aira caryophylla</i>	<i>Hordeum murinum</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Bromus diandrus</i>	<i>Hordeum murinum</i>	4001	Wawona Stables
Wawona Stables	4001	<i>Bromus hordeaceus</i>	<i>Hordeum murinum</i>	4039	Government Stables (YV)
Wawona Stables	4001	<i>Bromus tectorum</i>	<i>Hordeum murinum</i>	4093	McCauley Ranch
Wawona Stables	4001	<i>Chamomilla suaveolens</i>	<i>Hypericum perforatum</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Cynosurus echinatus</i>	<i>Hypericum perforatum</i>	4093	McCauley Ranch
Wawona Stables	4001	<i>Erodium cicutarium</i>	<i>Hypochaeris glabra</i>	4001	Wawona Stables
Wawona Stables	4001	<i>Herniaria hirsuta</i>	<i>Lactuca serriola</i>	3960	Hetch Hetchy Corral
Wawona Stables	4001	<i>Holcus lanatus</i>	<i>Lactuca serriola</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Hordeum murinum</i>	<i>Lactuca serriola</i>	4093	McCauley Ranch
Wawona Stables	4001	<i>Hypochaeris glabra</i>	<i>Leucanthemum vulgare</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Plantago lanceolata</i>	<i>Lolium multiflorum</i>	4039	Government Stables (YV)
Wawona Stables	4001	<i>Poa bulbosa</i>	<i>Lolium perenne</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Poa pratensis</i>	<i>Lychnis coronaria</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Polygonum arenastrum</i>	<i>Malva parviflora</i>	3960	Hetch Hetchy Corral
Wawona Stables	4001	<i>Rumex acetosella</i>	<i>Parapholis incurva</i>	3960	Hetch Hetchy Corral
Wawona Stables	4001	<i>Sisymbrium altissimum</i>	<i>Phleum pratense</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Sonchus oleraceus</i>	<i>Phleum pratense</i>	4093	McCauley Ranch
Wawona Stables	4001	<i>Spergularia rubra</i>	<i>Plantago lanceolata</i>	4000	Concession Stables (YV)
Wawona Stables	4001	<i>Vulpia myuros</i>	<i>Plantago lanceolata</i>	4001	Wawona Stables
Government Stables (YV)	4039	<i>Bromus diandrus</i>	<i>Plantago lanceolata</i>	8632	Tuolumne Stables
Government Stables (YV)	4039	<i>Bromus sterilis</i>	<i>Poa annua</i>	3960	Hetch Hetchy Corral
Government Stables (YV)	4039	<i>Bromus tectorum</i>	<i>Poa annua</i>	4000	Concession Stables (YV)
Government Stables (YV)	4039	<i>Capsella bursa-pastoris</i>	<i>Poa annua</i>	4093	McCauley Ranch
Government Stables (YV)	4039	<i>Chenopodium botrys</i>	<i>Poa annua</i>	7496	Harden Lake Corral
Government Stables (YV)	4039	<i>Erodium cicutarium</i>	<i>Poa annua</i>	7967	White Wolf Corral
Government Stables (YV)	4039	<i>Hordeum murinum</i>	<i>Poa annua</i>	8632	Tuolumne Stables
Government Stables (YV)	4039	<i>Lolium multiflorum</i>	<i>Poa bulbosa</i>	3960	Hetch Hetchy Corral
Government Stables (YV)	4039	<i>Poa bulbosa</i>	<i>Poa bulbosa</i>	4000	Concession Stables (YV)
Government Stables (YV)	4039	<i>Sisymbrium altissimum</i>	<i>Poa bulbosa</i>	4001	Wawona Stables
Government Stables (YV)	4039	<i>Stellaria media</i>	<i>Poa bulbosa</i>	4039	Government Stables (YV)
Government Stables (YV)	4039	<i>Urtica urens</i>	<i>Poa pratensis</i>	3960	Hetch Hetchy Corral
Government Stables (YV)	4039	<i>Vulpia myuros</i>	<i>Poa pratensis</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Aira caryophylla</i>	<i>Poa pratensis</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Bromus diandrus</i>	<i>Poa pratensis</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Bromus hordeaceus</i>	<i>Poa pratensis</i>	7496	Harden Lake Corral
McCauley Ranch	4093	<i>Bromus inermis</i>	<i>Poa pratensis</i>	7967	White Wolf Corral
McCauley Ranch	4093	<i>Bromus tectorum</i>	<i>Poa pratensis</i>	8632	Tuolumne Stables
McCauley Ranch	4093	<i>Centaurea solstitialis</i>	<i>Poa pratensis</i>	8695	Government Corrals (Tuol)
McCauley Ranch	4093	<i>Cirsium vulgare</i>	<i>Polygonum arenastrum</i>	3960	Hetch Hetchy Corral
McCauley Ranch	4093	<i>Convolvulus arvensis</i>	<i>Polygonum arenastrum</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Cynodon dactylon</i>	<i>Polygonum arenastrum</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Cynosurus echinatus</i>	<i>Polygonum arenastrum</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Erodium cicutarium</i>	<i>Polygonum arenastrum</i>	7967	White Wolf Corral
McCauley Ranch	4093	<i>Galium parisiense</i>	<i>Polypogon maritimus</i>	3960	Hetch Hetchy Corral
McCauley Ranch	4093	<i>Herniaria hirsuta</i>	<i>Rubus discolor</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Holcus lanatus</i>	<i>Rubus discolor</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Hordeum marinum</i>	<i>Rumex acetosella</i>	3960	Hetch Hetchy Corral
McCauley Ranch	4093	<i>Hordeum murinum</i>	<i>Rumex acetosella</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Hypericum perforatum</i>	<i>Rumex acetosella</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Lactuca serriola</i>	<i>Rumex acetosella</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Phleum pratense</i>	<i>Rumex acetosella</i>	7496	Harden Lake Corral
McCauley Ranch	4093	<i>Poa annua</i>	<i>Rumex acetosella</i>	7967	White Wolf Corral
McCauley Ranch	4093	<i>Poa pratensis</i>	<i>Rumex crispus</i>	3960	Hetch Hetchy Corral
McCauley Ranch	4093	<i>Polygonum arenastrum</i>	<i>Rumex crispus</i>	4000	Concession Stables (YV)

Site	Elevation (ft)	Exotic Species	Exotic Species	Elevation (ft)	Site
McCauley Ranch	4093	<i>Rubus discolor</i>	<i>Rumex crispus</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Rumex acetosella</i>	<i>Silene latifolia</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Rumex crispus</i>	<i>Sisymbrium altissimum</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Sisymbrium altissimum</i>	<i>Sisymbrium altissimum</i>	4039	Government Stables (YV)
McCauley Ranch	4093	<i>Sonchus asper</i>	<i>Sisymbrium altissimum</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Spergularia rubra</i>	<i>Sonchus asper</i>	4093	McCauley Ranch
McCauley Ranch	4093	<i>Stellaria media</i>	<i>Sonchus oleraceus</i>	3960	Hetch Hetchy Corral
McCauley Ranch	4093	<i>Tragopogon dubius</i>	<i>Sonchus oleraceus</i>	4000	Concession Stables (YV)
McCauley Ranch	4093	<i>Trifolium repens</i>	<i>Sonchus oleraceus</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Verbascum thapsus</i>	<i>Spergularia rubra</i>	4001	Wawona Stables
McCauley Ranch	4093	<i>Vulpia myuros</i>	<i>Spergularia rubra</i>	4093	McCauley Ranch
Harden Lake Corral	7496	<i>Capsella bursa-pastoris</i>	<i>Spergularia rubra</i>	7496	Harden Lake Corral
Harden Lake Corral	7496	<i>Herniaria hirsuta</i>	<i>Spergularia rubra</i>	7967	White Wolf Corral
Harden Lake Corral	7496	<i>Poa annua</i>	<i>Spergularia rubra</i>	8632	Tuolumne Stables
Harden Lake Corral	7496	<i>Poa pratensis</i>	<i>Stellaria media</i>	3960	Hetch Hetchy Corral
Harden Lake Corral	7496	<i>Rumex acetosella</i>	<i>Stellaria media</i>	4000	Concession Stables (YV)
Harden Lake Corral	7496	<i>Spergularia rubra</i>	<i>Stellaria media</i>	4039	Government Stables (YV)
Harden Lake Corral	7496	<i>Trifolium repens</i>	<i>Stellaria media</i>	4093	McCauley Ranch
Harden Lake Corral	7496	<i>Veronica persica</i>	<i>Stellaria media</i>	7967	White Wolf Corral
Glen Aulin High Sierra Camp	7832	<i>Taraxacum officinale</i>	<i>Taraxacum officinale</i>	4000	Concession Stables (YV)
Glen Aulin High Sierra Camp	7832	<i>Trifolium repens</i>	<i>Taraxacum officinale</i>	7832	Glen Aulin High Sierra Camp
White Wolf Corral	7967	<i>Capsella bursa-pastoris</i>	<i>Taraxacum officinale</i>	7967	White Wolf Corral
White Wolf Corral	7967	<i>Chamomilla suaveolens</i>	<i>Taraxacum officinale</i>	8632	Tuolumne Stables
White Wolf Corral	7967	<i>Poa annua</i>	<i>Torilis arvensis</i>	3960	Hetch Hetchy Corral
White Wolf Corral	7967	<i>Poa pratensis</i>	<i>Tragopogon dubius</i>	4000	Concession Stables (YV)
White Wolf Corral	7967	<i>Polygonum arenastrum</i>	<i>Tragopogon dubius</i>	4093	McCauley Ranch
White Wolf Corral	7967	<i>Rumex acetosella</i>	<i>Trifolium repens</i>	4000	Concession Stables (YV)
White Wolf Corral	7967	<i>Spergularia rubra</i>	<i>Trifolium repens</i>	4093	McCauley Ranch
White Wolf Corral	7967	<i>Stellaria media</i>	<i>Trifolium repens</i>	7496	Harden Lake Corral
White Wolf Corral	7967	<i>Taraxacum officinale</i>	<i>Trifolium repens</i>	7832	Glen Aulin High Sierra Camp
White Wolf Corral	7967	<i>Trifolium repens</i>	<i>Trifolium repens</i>	7967	White Wolf Corral
Tuolumne Stables	8632	<i>Dactylis glomerata</i>	<i>Trifolium repens</i>	8632	Tuolumne Stables
Tuolumne Stables	8632	<i>Herniaria hirsuta</i>	<i>Urtica urens</i>	4039	Government Stables (YV)
Tuolumne Stables	8632	<i>Plantago lanceolata</i>	<i>Verbascum thapsus</i>	4000	Concession Stables (YV)
Tuolumne Stables	8632	<i>Poa annua</i>	<i>Verbascum thapsus</i>	4093	McCauley Ranch
Tuolumne Stables	8632	<i>Poa pratensis</i>	<i>Veronica persica</i>	7496	Harden Lake Corral
Tuolumne Stables	8632	<i>Spergularia rubra</i>	<i>Vulpia myuros</i>	3960	Hetch Hetchy Corral
Tuolumne Stables	8632	<i>Taraxacum officinale</i>	<i>Vulpia myuros</i>	4000	Concession Stables (YV)
Tuolumne Stables	8632	<i>Trifolium repens</i>	<i>Vulpia myuros</i>	4001	Wawona Stables
Government Corrals (Tuol)	8695	<i>Bromus catharticus</i>	<i>Vulpia myuros</i>	4039	Government Stables (YV)
Government Corrals (Tuol)	8695	<i>Poa pratensis</i>	<i>Vulpia myuros</i>	4093	McCauley Ranch
<b>Species Richness Summary - by Corral/Stable Site</b>			<b>Species Richness Summary – by Richness level</b>		
		<b>Exotic Species</b>			<b>Exotic Species</b>
<b>Site</b>	<b>Elevation</b>	<b>Richness</b>	<b>Site</b>	<b>Elevation</b>	<b>Richness</b>
Concession Stables(YV)	4000	33	Glen Aulin High Sierra Cmp	7832	2
Glen Aulin High Sierra Camp	7832	2	Government Corrals (Tuol)	8695	2
Government Stables (YV)	4039	13	Harden Lake Corral	7496	8
Government Corrals (Tuol)	8695	2	Tuolumne Stables	8632	8
Harden Lake Corral	7496	8	White Wolf Corral	7967	10
Hetch Hetchy Corral	3960	31	Government Stables (YV)	4039	13
McCauley Ranch	4093	33	Wawona Stables	4001	20
Tuolumne Stables	8632	8	Hetch Hetchy Corral	3960	31
Wawona Stables	4001	20	Concession Stables(YV)	4000	33
White Wolf Corral	7967	10	McCauley Ranch	4093	33
<b>Species of Corrals/Stables</b>		<b>Total = 62</b>	<b>Species of Corrals/Stables</b>		<b>Total = 62</b>